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Design of Industrials

Planning for Their Economical and Efficient Operation

By James M. Green, Jr.

THE foremost feature of modern American industry is the application of known systematic standards in lieu of the earlier trial-and-error methods. Modern conditions have brought into organized industry systematic co-ordination of all the relative factors functioning for successful enterprise. The policy is broad gauge, and investment is stabilized by analysis of the economics of manufacturing, design and layout of plant, economy in production processes, effective control of material, organization and administrative attributes, and the location.

The best rounded-out plan for manufacturing enterprises is based upon correct design as related to its location and physical characteristics as well as effective operation.

It is obvious that industrial problems are too highly specialized, and too broad in scope of activities and forms of organization for the average architect to pose as a dabster in their efficient and economical solutions.

Industrial management is applying to questions of business the methods and analysis characteristic of engineering practice; the work is based upon facts of process and operating technic, and with the first taking priority, this management service may be logically classed as engineering. *Management engineering* is a term increasing in popularity and which is synonymous with the development and operation of productive industries.

The Production Engineer, the Industrial Engineer, and the Management Engineer are to productive industry what the Building Manager is to the industry of effective operation of commercial structures.

Just as the architect and building manager collaborate for the creation of sound structural investment, so should the architect and the management engineer organize their services to develop the successful industrial plant.

The right time for the architect and the engineer to get together is before the site has been purchased. If they, perhaps, consulting with equipment specialists, will co-operate to set forth their calculations in a clear and accurate outline, even if their early investigations do not entirely conform to a final given condition, the gist of the scheme is there, *au fond*, and it will be hard to go wrong. Too much original thought in planning is impossible; it is economical to the architect in the preparation of his drawings and, likewise, the result is reflected in plant operation. It is certainly much better to plan the plant around the organization than to pack the organization into mere buildings.

From an architectural perspective, industrial construction contains all the elements entering into commercial construction *plus* the engineering features of production processes and the allied problems of labor.

It is these conditions added to the structural elements which place the work in another category, and make the architect reliant upon the specialized knowledge of the management engineer. Therefore, we may discuss industrial structural economics in two phases: first, from the aspect of the management engineer as he schemes with the architect to unify the factors entering into the design and organization of industrial plants; and second, from the view-point of the architect who assimilates the theoretical factors of economic investigation and translates them into terms of structure.

Differentiated from the management of commercial buildings, the management of industrial plants along scientific lines includes these important elements:

1. Planning of the processes.
2. Planning of the operations in detail.
3. Functional organization, by which each superintendent is made responsible for specific effort. This as opposed to the older type of organization in which every manager admixed executive, legislative, and judicial functions.
4. Increasing the efficiency and productiveness of labor and operations.
5. Establishment of standard unit operations for basis of fair payment.

Mr. P. F. Walker, in his book "Management Engineering," classifies industries thus:

Group A.—Industries in which the *raw materials* determine the character and, within limits, the quality of the product. That is, while equipment and process and labor are not without effect, in this group of enterprises material plays the major part. Salt refining, ordinary lumber mills, raw sugar mills, and canning and preserving, are familiar examples.

Group B.—Industries in which *equipment* determines the character and quality of the product. Of course, material continues to have influence, as it always will, as also do labor and process steps. But we may distinguish in such activities as shoe manufacturing, milling of patented cereals, pressed-metal-goods plants, cordage and twine plants, and many others, conditions wherein labor and materials must be made to accord with the demands of the equipment. Equipment sets the pace as well as quality standards.

Group C.—Industries in which *process* determines the character and quality of the product. This group shades gradually from the one dominated by equipment, but there are distinctive differences. Two oil refineries may use essentially the same kind of equipment, but their products may differ radically. This is the result of placing experts in control—men who know how to control the process. So it is with the coal-tar dyes and a host of other chemical industries, including cement, glucose, leather, bakery goods, and steel.

Group D.—Industries in which *labor* determines the quality and character of the product. Here, again, there are gradually shaded variations with some difficulty in seeing just where equipment ceases to control labor and labor begins to control equipment, but in the great majority of manipulated industries the difference is clear. Fabricated articles, whether in steel, in cloth fabrics, in wood, in tobacco, or in leather, represent the group. We have here the demand for high average skill among workers, as distinguished from the demand for a few highly trained directors of process, in the preceding group.

In any analysis of conditions which bear upon the questions confronting any one starting an enterprise, certain things must be settled. Some pertain to local conditions and others are inherent in the business. Naturally, the management engineer understands the business, just as the architect understands the domain of design, but both must understand each other to prescribe successful operation formulæ. As exemplified by organization plans of thriving enterprises, the conditioning factors may be thus grouped:

Production Factors.
Selection of Site.
Design of Plant.

1. *Production Factors:*
 - Market.
 - Capital.
 - Materials: Quality and supply.
 Process materials.
 Constituent materials.
 - Related industries.
 - Process.
 - Equipment.
 - Climatic conditions.
 - Labor: Skilled.
 Unskilled.
 - Power availability, and cost.
 - Transportation facilities.

2. *Selection of Site:*
 - (*a*) Raw materials:
 1. Supply.
 2. Fuel.
 3. Source.
 - (*b*) Finished product: juxtaposition into cost of:
 1. Transportation.
 2. Weight.
 3. Distribution.
 4. Time elements.
 - (*c*) Economic considerations:
 1. Land values.
 2. Taxation.
 3. Accessibility to railway lines.
 4. Local traffic facilities.
 5. Highways.
 6. Water supply.
 7. Sewerage lines.
 8. Disposal of obnoxious wastes.
 - (*d*) Labor supply:
 1. Transportation.
 2. Housing:
 - Method.
 - Local materials.
 - Adaptation to living standards.
 - Districts for: Skilled.
 Unskilled.
 3. Social conditions:
 - Racial attributes.
 - Construction climatic influences.
 - Recreation.
 - Religious and educational advantages.
 4. Economic conditions:
 - Proximity to:
 - Markets.
 - Business.
 - Commercial and professional services.
 - Transportation:
 - Steam.
 - Electric.
 - Motor and highways.

3. *Design of Plant:*
 - (*a*) Accurate adaptation of buildings to process needs.
 - (*b*) Equipment needs as affecting the actual floor space required. This demands an exact detailed study of the processes and a listing of all items of requirements for production, routing, and administrative control.
 - (*c*) Administrative requirements in so far as they yield an influence upon arrangement of area and equipment.
 - (*d*) Auxiliary service requisites:
 1. General offices.
 2. Hospital facilities.
 3. Welfare of employees.
 4. Parking space.
 5. Outdoor recreation space.
 6. Quarters for training apprentices.
 - (*e*) General design of buildings:
 Concepts: Simplicity, good taste, and sound construction are the recognized tenets of the doctrine of economic balance between the organism of industry as it unites structural materials and human forces.
 1. Space requirements.
 2. Effect of beauty on:
 - Working conditions.
 - Establishment of public prestige.
 3. Process and administrative requirements.
 4. Single or multiple floors:
 - In choosing between single and multiple floors in buildings, in cases where the service is for light materials which might be handled on different levels, one must be guided by the facts that, on one hand, the investment is less for multiple floors in proportion to the actual floor area secured, while on the other hand, the effectiveness of labor in manufacturing is greater in the utilization of only one floor. The estimates of economy will vary with different types of work and analysis of costs is necessary to find the best solution.
 5. Future growth.
 6. Unit or isolated buildings.
 7. Selection of construction types.
 8. Fire hazards.
 9. Width of buildings:
 - Roof truss or beam spans.
 - Column spacing.
 10. Roof types.
 11. Floor material.



MONTGOMERY WARD BUILDING, ST. PAUL, MINN., REINFORCED CONCRETE CONSTRUCTION WITH MONOLITHIC CONCRETE EXTERIOR. W. H. McCaully, Engineer and Architect.



MONTGOMERY WARD BUILDING, BALTIMORE, MD. W. H. McCaully, Engineer and Architect.

12. Lighting:
 Orientation and fenestration.
 Artificial.
13. Sanitation.
14. Supports for cranes and shafting.
15. Ventilation.
16. Comforts and conveniences.
17. Service steam, water and gas lines.
18. Power plant and auxiliary equipment:
 The power element in industrial design is one calling for serious consideration. The management engineer will hardly be an expert in the design of the power plant when considered as a unit by itself, but he should be well versed in current practice in its most advanced forms. The adaptation to the physical needs of the enterprise alone determines individual requirements, and with capable consulting services, difficulties are readily overcome.

Industrial plants represent a great part of the wealth of the currency and valuables deposited in banks by the public and turned into capital goods. The plant and the bank, akin in business, represent an architectural cleavage: one is a *probleme de luxe*, the other draws sharp lines of demarcation between effect and economics, and the architect is vitally restrained in his artistic imageries. From his view-point, an industrial plant is developed by utilization of the basic factors as determined by him and the management engineer in preliminary investigations.

Unconsciously, or deliberately, if you please, because of the architect's inherent psychological understanding of the principles underlying design, there will be manifest, in the final result, a refinement of limitations, based upon his individual study of these elements:

Site Considerations:

1. Characteristics of land:
 Topography.
 Physical.
2. Orientation and axes with respect to:
 Natural contour.
 Highways.
 Access for pedestrians.
 Vehicle access and parking space.
3. Plot plan.
4. Railway transportation.
5. Switching facilities.
6. Power and auxiliary services.

Layout:

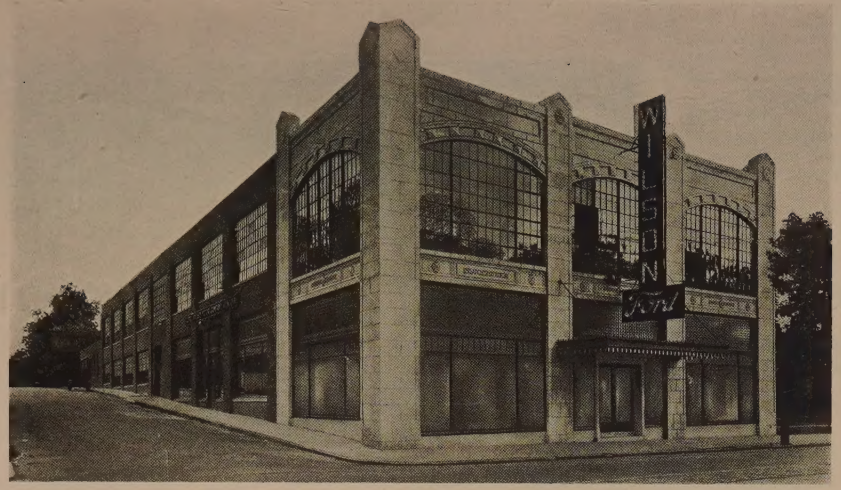
1. Plot plan.
2. Public spaces.
3. Administrative features.
4. Essentials of process:
 Single structure.
 Distributed structures.
 Shop routine.
 Routing diagrams.
 Materials:
 Assembling.
 Testing.
 Handling and issuing.
 Loading platforms.
5. Building and plant service demands:
 Power plant.
 Heat.
 Water supply.
 Plumbing.
 Electric service.
 Elevators and lifts.
 Ventilation.
 Vacuum system.
 Sprinkler system.
 Fire appliances.
 Filtration.
 Refrigeration.
 Gas, oil, and air.
 Special equipment.
6. Future growth:
 Lateral extension.
 Vertical extension.
 Unit additions.

Construction Studies:

1. Types.
2. Single or multiple stories.
3. Style of design.
4. Appearance:
 Determination of the economic limitation where additional expenditures for artistic effect cease to yield a corresponding revenue through additional value as an advertising medium or as a stimulant to the quality of inter-plant workmanship.
5. Materials:
 Cost.
 Kinds.
 Longevity.
 Local markets.
6. Cubic foot standards.
7. Unit or separate buildings.
8. Insurance:
 Hazards.
 Fire preventions.
9. Working conditions: Male and female:
 Comfort.
 Convenience.
 Heating.
 Lighting.
 Ventilation.
 Sanitation.
 Safety.
 Recreation.
 Beauty.

Housing.
Community centres, etc.

Four or five decades ago the entire matter of industrial design was a thing to be settled individually. A wilful captain of business, a bricklayer and a blacksmith were all that was needed. To-day, every existing agency is utilized for the economical production of goods and enterprise is accelerated under a competitive regime. The distribution of labor, shorter and more intense hours, high standards and wages have become national problems. Reform and philanthropy have done much to elevate the conditions of living by increasing productiveness and stimulating loyalty through payment of part of increased profits to the workman. The problem is beyond individual control, it is an evolution of social and economic forces; it is highly specialized; a particular theme for the architect and management engineer.



WILSON MOTOR CO. BUILDING, CHARLOTTE, N. C.

Lockwood, Greene & Co., Architects and Engineers.

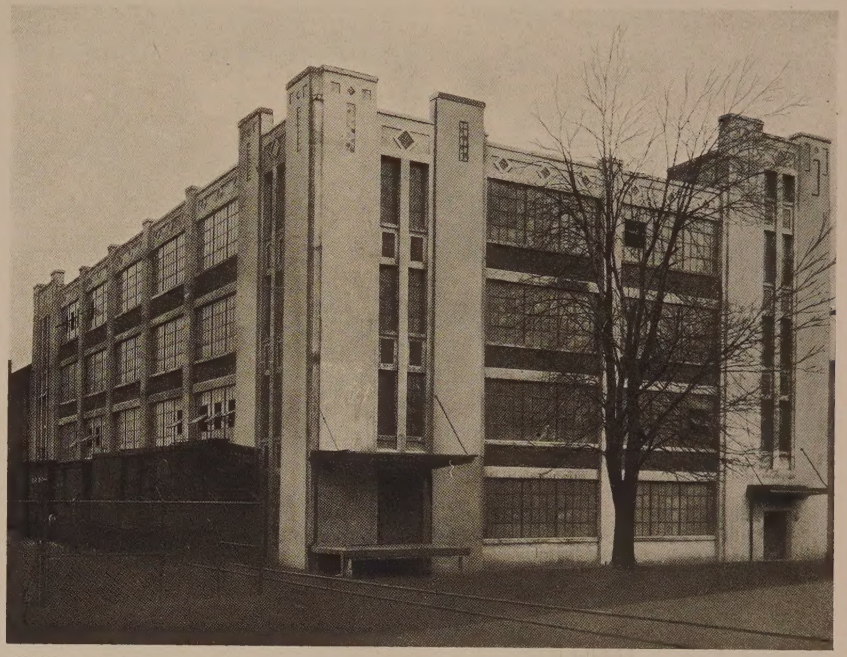
The quality of individuality is given to this new building without adding materially to its cost. It is of fireproof construction, of reinforced concrete columns, beams, and floors, with brick-bearing walls. The floors have a granolithic finish except in the showroom and the parts department, where ceramic tile is used. A ramp of reinforced concrete permits the driving of cars directly to the second floor.



WAREHOUSE AND SERVICE BUILDING,
L. BAMBERGER & CO., NEWARK, N. J. Abbott, Merkt & Co., Engineers.



GENERAL BAKING CO., BROOKLYN. C. B. Comstock, Architects.



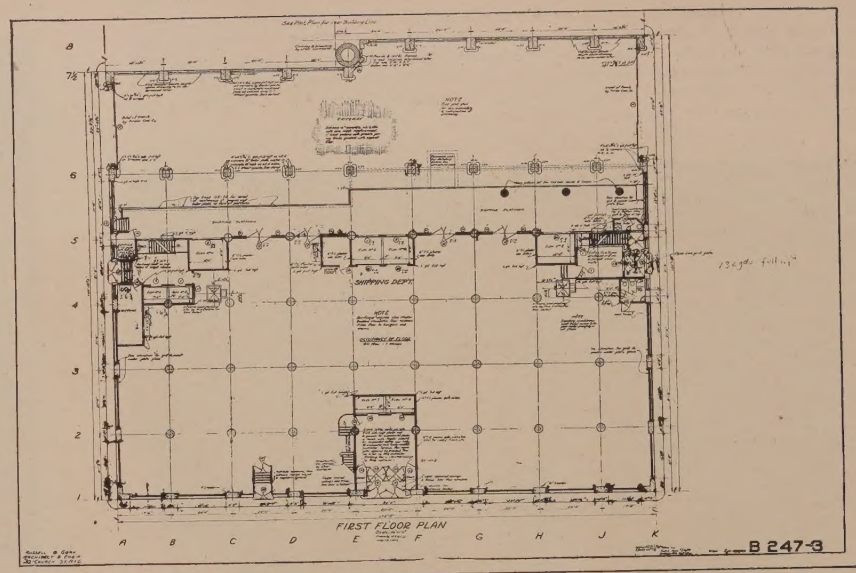
THE MOSAIC TILE COMPANY BUILDING, ZANESVILLE, OHIO.

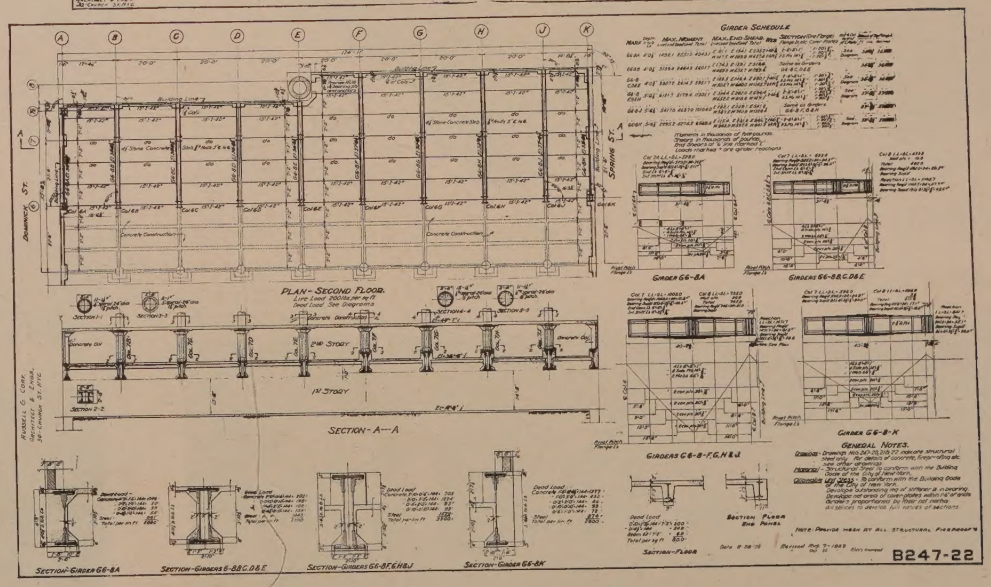
Lockwood, Greene & Co., Architects and Engineers.

The Mosaic Tile Company Building, Zanesville, Ohio, was completed without a single extra being listed on the general contract. It is a typical modern industrial building, with a conveniently arranged and well-lighted interior. At present it is to be used for sorting, storing, packing and shipping the finished product, which consists of glazed and unglazed tile for interior and exterior use, some of which can be seen in the parapet wall and between the big corner pilasters.









The American News Company, Inc., New York City

Russell G. Cory, Architect. Walter M. Cory, Associate. Turner Construction Company.

This building covers one-third of the city block bounded by Hudson, Spring, Varick, and Dominick Streets, and contains 300,000 square feet of floor space devoted to the receiving mainly of books, periodicals, and stationery supplies, and the relatively quick reshipment of these commodities in the filling of many thousands of separate orders daily. The larger part of these shipments goes to distant points, while the remainder serves the local stores and news-stands.

Its principal function is to inhale and exhale commodities. This leads to unusually ample elevator capacity—four passenger elevators, four freight elevators, and two electric dumb-waiters for interdepartmental service; and an exceptionally spacious driveway, running through the building from Dominick to Spring Streets, and accommodating eighteen trucks at the shipping platform at one time.



E. R. Squibb & Sons Building, Brooklyn

Russell G. Cory, Architect. Walter M. Cory, Associate.
Turner Construction Company.

THIS building was planned and built principally for centralization of all large process manufacture, and to take care of increased demand for the company's products. The location selected at Columbia Heights and Vine Street, Brooklyn, which is an extension to the existing plant, offers an excellent labor market, a short trucking haul to the large local market and accessibility to both rail and water shipments.

The building is of reinforced concrete throughout, thirteen stories in height, which is very suitable to a gravity flow of materials in process of manufacture, from the thirteenth floor downward to the fourth floor. The third floor is devoted to offices and the second floor contains the mechanical department. The finished goods storage is on the first floor together with the shipping department. The actual shipping platform, together with space for the assembly of finished goods ready for shipment, is on the other side of Columbia Heights from the main building, and is reached by an underground passage equipped with conveyors operating in both directions. As the power-house is located near the shipping platform and entirely separate from the main building, the tunnel under Columbia Heights also serves to contain the mechanical piping and power wiring to supply the main building.

As the plant is favorably located for advertising display, advantage was taken of this fact in the design of the roof structures, which are continuously illuminated in colors at night.



Frank G. Shattuck Co. Building

Russell G. Cory, Architect. Walter M. Cory, Associate.
Turner Construction Company.

THE Shattuck Building is located on the relatively expensive property on 22d Street between Fifth and Sixth Avenues to supply ice-cream and candy to the twenty-eight (28) Schrafft Candy Stores located principally in Manhattan and Brooklyn. This location is favorable to the type of labor required in the operations of manufacture, but it is of far greater importance in the matter of meeting a demand for ice-cream which fluctuates widely from hour to hour. The cause of this variation in demand is the noon-hour rush, as well as other unexpected conditions, such as the effect of warm sunny weather after a cold rain, giving rise to sudden demands for ice-cream from many stores. This commodity cannot be made in quantity and stored for emergency. It must be made in a building capable of turning out large quantities on short notice, and the building must be located at a central point from which deliveries to the various stores can be made in a few minutes or the demand cannot be met, and last but not least, in fact greatest of all, this location insures delivery at all times of strictly fresh home-made candy as fast as it is made. This is an unusual condition for a factory building to have to meet and justifies the location chosen.

The building is constructed throughout of reinforced concrete, thus effecting a saving of approximately 10 per cent in cost as compared with a similar building designed with a steel frame and brick walls. Suitable architectural treatment to make the building accord with the neighborhood

was secured at a very slight increase in the cost over that of the necessary concrete structural frame.

The column spacing of 25 feet cost eight (8) cents per square foot of floor space more than it would have cost with the more usual spacing of 20 feet centre to centre of columns, but this item is amply repaid by the greater facility in the arrangement of space.

There are practically no finished goods stores provided in this building. The nature of the business calls for manufacture just sufficient to meet a simultaneous demand, the product being shipped only to the stores operated by the company.

To insure perfect sanitation, the floors of all manufacturing space are either tile or composition, and the walls are tiled and enamelled.

Two floors are maintained with the air at constant temperature and constant moisture content throughout the year and under varying conditions of weather. These floors are separated by a cork lining from the remainder of the building and the windows are double glazed. On these two floors the finished candy is received, packed and shipped with the utmost despatch to insure absolutely fresh product.

Numerous studies of production and routing both before and during the period of construction determined the interior arrangements and mechanical equipment to secure the maximum usefulness of the property.



EDIBLE COCOANUT COMPANY, CANDALARIA, P. I. Charles H. Higgins, Architect.

Twelve tons daily for the American table. All processes, from the nuts delivered from the trees to the shredded cocoanut packed and ready for use in the United States. Completed and put in operation in 1925.



ABNEY–BARNES CO., CHARLESTON, W. VA.
Charles H. Higgins, Architect.

First floor, in front, is given up to receiving customers, who are the country storekeepers from all over the State; and, rear, to shipping of goods. Goods are received in the basement and elevated directly to the top of the building. On top there are two floors for warehouse purposes. Between are four floors—one for each of the four departments. Here goods are displayed on shelves from which the customer selects for purchase.



STORAGE WAREHOUSE, Moores & Dunford, Inc., Architects.
GEO. B. HOLMAN & CO., INC., HACKENSACK, N. J.

For storage, packing, shipping, and carpet cleaning. Built in residential section. The few extra thousand dollars added to the original estimates of the cost of this building have proved the best of investments from an advertising point of view.

The New Repertory Theatre, Boston, Mass.

A Unique Contribution toward the Betterment of Dramatic Art

J. Williams Beal Sons, Architects

THE public concept of a theatre has been a place where one may go to be amused, and but little fundamental distinction has been made between theatrical performances and nearly all other public spectacles. One selects this or that to watch much as his taste inclines him to one or another of the items on a restaurant menu. Of course there have been some among the public, always a minority, who have seen æsthetic and educational values in the theatre. Public taste, therefore, has been the determining factor in the success of the stage, and the line in front of the box-office has been the barometer by which the life of the current play was to be gauged. Theatre management is full of examples of plays which, technically good, have failed to make a sufficient appeal to the public, and the opposite is equally true of many shows of quite inferior type. It is very pleasing now to observe that those who have the welfare of the theatre at heart realize that the conservation of all that is best in the spoken drama depends upon lifting the public taste and that these leaders are energetically at work in that direction.

The new Repertory Theatre of Boston takes a place in the front rank of the movement. In its practical form it provides an auditorium with the usual accessories for the comfort and pleasure of its patrons, a stage for the best possible production of the play, and a building connected thereto which is unique in its provisions for dramatic study and the encouragement of a variety of activities, all leading up to the better support of dramatic art. The architectural problem involved in meeting these requirements was aggravated by the small area of the lot and certain restrictions and limitations imposed by deeds and the building law.

The design of the façade, carried out for the most part in limestone and red antique water-struck brick, was given a Georgian character as best expressing both the historical background of the institution and the best traditions of Boston; and a certain balance was aimed at between the institutional character of a public building and domestic character carrying a feeling of intimacy. On the interior the same architectural expression is maintained; simple and quiet in treatment but sufficiently enriched by a variety of materials, decorated mouldings, and panelling to give a feeling of warmth and dignity. The small size of the auditorium has the effect of bringing the audience closer to the architectural treatment, and this closeness, as a demonstrated fact, gives the audience more of an "at-home" feeling. Though this is an intangible matter, it nevertheless is a distinct asset, and the architectural treatment enhances it without losing any of its own absolute value.

The fore part of the theatre, besides the usual foyer, men's and ladies' rooms, etc., has a tea-room on the entrance floor served by a kitchen and dumb-waiter from below; and, in the basement, as an unusual feature, an art room where a valuable collection of furniture and paintings is placed for exhibition and sale. A counter for refreshments is also found in the basement lounge, which completes an arrangement under which man is well served both externally and internally.

The stage is deep and wide, the governing consideration having been to provide perfect facilities for any kind of play regardless of the size of the auditorium, which seats about 950. In completeness of stage equipment nothing is lacking. The floor is trapped over a large area and a high gridiron permits scenery to be raised above the curtain line without "tripping." A complete system of counter-weights, blocks, and pin-rail permit efficient and rapid handling of all pieces during a performance. The orchestra pit can be raised and lowered to conform to any special requirements that may arise. Fly-galleries on each side of the wings are connected by a paint-bridge on which a gas-stove and sink are conveniences of great value in the work carried on there.

The stage lighting was designed to provide the utmost flexibility of control and the maximum range of scenic effects, and was arranged and carried out by Mr. Munroe R. Pevear. In many ways it constitutes a considerable departure from the conventional system, only the Theatre Guild of New York having anything similar. The usual borders have been eliminated and a cyclorama back drop installed. This at the bottom rests in a shallow pit extending from wing to wing, and is lighted here by a row of high-powered lights each in its own compartment with a strong reflector. Over each light a slide containing any desired color is inserted, and, as the row is wired on several circuits operating through the dimmer bank, any desired colored effect can easily be obtained. A similar arrangement of lights is installed across the top of the cyclorama, and the combination above and below achieves a complete palette of colors subject to perfect manipulation through the switchboard. A battery of spot-lights is set vertically on each of the proscenium strips, each of the same type as those used at the cyclorama, and footlights of the usual kind are placed at the front of the stage. Another strip of spot-lights, the "teasers," is placed across just above the top of the proscenium opening. To assist further in obtaining color effects six spot-lights are installed in the projection booth in the ceiling at the back of the house, and as these are controlled from the stage they play an important part in the scheme of stage lighting.

To control this equipment a switchboard of the most modern design has been installed together with an unusually large dimmer bank. The switchboard is of the so-called "dead-front" type, and is equipped with eighty-four switches. At the top of switchboard a dimmer bank made up of seventy plates has been mounted. The switchboard and the dimmer bank comprise one of the largest units in any theatre in Boston, and by means of it any or all of the lights in the auditorium or on the stage may be turned on or off and dimmed or brightened as may be desired.

On one side of the stage switchboard a panel controlling the dressing-room call system has been installed. By means of this any dressing-room may be called to inform the artist when it is time to appear on the stage. The artist may also return the call to let the stage-manager know that he or she is ready. This system avoids many exasperating delays and helps to keep the wings clear.

The projection booth also includes two picture-machines and one stereopticon. These will be used in conjunction with a programme of educational moving pictures to be given Saturday mornings to school-children. A series of

historical photoplays, sponsored by Yale University, will be shown and unquestionably will be of tremendous value and interest to the young audience.

The heating system designed for this building is the low-pressure steam, vacuum type, the vacuum on the system being maintained by a motor-driven pump. Steam is supplied from two large sectional boilers arranged so that coal or oil may be burned as may be deemed best. Direct heat for the theatre is provided by radiators placed at proper points to protect the audience from cold drafts, and for the most part these radiators are concealed behind grilles.

Ventilation is provided for the theatre by both supply and vent fans driven by electric motors. The supply-fan delivers not less than 1,500,000 cubic feet of cleaned and tempered air per hour, and the vent-fans remove the same amount of vitiated air. The cleaning of the air is accomplished by an air-washer through which all the air delivered into the theatre is passed. The air is then forced by the supply-fan into the theatre at a very slow velocity through ornamental plaster grilles in the ceiling. The foul air is exhausted by the vent-fans through mushrooms which are placed in the floor under the seats, and which are so arranged as to create a proper distribution of fresh air throughout the theatre. Additional vent-fans are provided to remove all odors from toilets, smoking-rooms, lounging-rooms, lobbies, and other public rooms. All these fans and the motors which operate them are specially sized and installed on insulated foundations to prevent noise and vibration.

Extending out as a wing from the rear of the theatre proper is the portion known as the Club Building. Here are found excellent provisions for the many-sided activities of the Jewett Repertory Fund Incorporated, the organization whose tireless and far-seeing efforts have made a reality of their visions and promise so much for the future of dramatic art. Direct communication is maintained between the substage area and the basement of the club building, and an inspection of the plans will reveal the wealth of accommodations here and on the first floor of the club building for every phase of stagecraft. Not only are all the requirements of the operating stage and the actors foreseen but likewise all that is necessary for the successful functioning of a school of dramatic art which will be inaugurated here. Its work will comprise play-writing, acting, scenery-painting, stage management, and theatre management, the last being unique in theatre history. This school will have a regular curriculum and faculty, and will co-ordinate its work with both the active stage and similar schools elsewhere.

The second floor of the club building contains the large assembly hall which is intended to be let to the public for afternoon or evening dances, concerts, banquets, etc., or to be used by the theatre organizations and school in developing their work for the theatre stage. Paralleling the theatre is a corridor which brings the public to the assembly-hall lobby, around which are grouped the ticket-office, check-room, and men's and ladies' rooms. On a mezzanine level above, a spacious lounge provides every comfort for club members and patrons of the hall. A fireplace, library, facilities for afternoon tea, and appropriate furniture take their places naturally in a setting of comfort and clublike atmosphere.

At the other end of the hall a stage provides opportunity for concert or dramatic work of a lighter kind, and behind is a well-fitted-up serving-room designed to meet all demands that a large banquet may impose. Above are dressing-rooms for those using the stage.

This review of the Repertory Theatre of Boston has mentioned only the outstanding points in an institution which for completeness of physical equipment coupled with a mental energy that is making theatre history has as yet no rival. Public recognition of the place it has taken has already come in the official declaration that it is an educational institution, and as such it is declared exempt from taxation, the first of its kind, though we may hope not the last.

For Students of Architecture

THE governing committee of the James Harrison Steedman Memorial Fellowship in Architecture announces the first competition for a fellowship of the value of fifteen hundred dollars, the holder of which is to pursue the study of architecture in foreign countries, as determined by the committee and under the guidance and control of the School of Architecture of Washington University, St. Louis.

Qualifications of Candidates

This fellowship is open on equal terms to all graduates in architecture of recognized architectural schools of the United States.

Such candidates, who shall be American citizens of good moral character, shall have had at least one year of practical work in the office of an architect practising in St. Louis, Mo., and shall be between twenty-one and thirty-one years of age at the time of appointment to this fellowship.

AN Architectural School and Tour of Instruction whose itinerary and programme are most attractive, is the one announced under the direction of Professor Paul Valenti, of Washington University, St. Louis.

Students of Architecture, and others having similar interests, who are contemplating a visit to Italy for the purpose of completing, by personal investigations, their studies initiated at home, will be pleased to learn that an exceptional opportunity is now being offered them by the Royal Italian Government.

Authorization.—Under the direction of Professor Paul Valenti, this Summer School and Tour of Instruction is being organized with a definite educational object in view. Authorized by the Royal Italian Government, which will co-operate to the end that American students may profit in the highest degree, this special travelling Summer School presents the greatest possible advantages. Professor Valenti is a graduate of the Royal Academy of Fine Arts in Milan, Italy, has devoted a number of years to the study of architecture, archæology, and ethnology in the land of his origin, is now a member of the faculty at Washington University, and was recently knighted by the King of Italy.

Announcements

A. F. Amodio, architect and civil engineer, desires to announce that he has opened his main office at 309 Commerce Building, Atlantic and North Carolina Avenues, Atlantic City, N. J. Catalogues requested.

Charles K. Bryant announces that he has opened an office at 1367 S. W. 5th Street, Miami, Fla. Catalogues and samples requested.

ARCHITECTVRE*
Published by Charles Scribner's Sons
THE PROFESSIONAL ARCHITECTVRAL MONTHLY
*Reg. U. S. Pat. Office

Editorial and Other Comment

For the Better Education of the Layman

THE educated Englishman would hardly think his training complete without some pretty definite knowledge of the history of architecture. It is just as much a part of his cultural equipment as a knowledge of the classics or an acquaintance with the English poets. Fortunately for him, the environment in which he acquires his education contributes a great deal to his interest and understanding of architecture. One can hardly spend any time at Oxford or Cambridge or at any of the great English public schools without imbibing, even without effort, some enthusiasm for the traditional Gothic. An air of antiquity, ivied quadrangles, time-worn stones, picturesque towers, mullioned windows, quaint chimney-stacks, dark vaulted passageways, elaborately decorated doorways are an every-day incident. If he does not become curious and pursue the investigation of Gothic details from Early English to Late Tudor he, at least, knows the difference between Gothic and, let us say, Romanesque, for he may see the difference made plain in several of the great cathedrals, and wherever he goes the appeal of the local architecture is apt to pique his interest and lead him to further study.

This interest of the English in the subject of architecture is manifested in the large number of books that deal with it, from such comprehensive and wonderful volumes as Bannister-Fletcher's great history, with its multitude of illustrations, to hundreds of minor books that introduce the subject in familiar terms, or at least make an effort to do so.

There are books about the cathedrals, books about the little country parish churches, delightful reading, both for their architecture and touches of local history.

There are A B C's of architecture, books that try to explain the technicalities of Gothic vaulting in words of one or more syllables, etc., etc.

All of these books show a demand for knowledge quite out of the ordinary, and that they are profitable would seem evident by the frequent issue of new editions.

Apart from the mere architectural interest in books of this kind is the added interest of the history that is an inevitable part of their writing. We may trace the development of a nation's civilization in her architecture, study the way people lived, and follow their ideas of what to them constituted the beautiful.

As in the art of painting, architecture is associated with the names of the great leaders of their time. In the personalities and experiences of these men we may follow the old human story of genius, trial, success and failure, of struggle against enemies, jealous rivals, unscrupulous men of authority and wealth.

We often wonder how many of the private libraries in this country are equipped with an adequate shelf of books on the history of architecture, just as we wonder how many of the students in our universities outside of the architectural schools really take any interest in the subject.

The fact of the matter is, however, that we are lacking in inexpensive non-technical and readable volumes about this immensely interesting subject.

The American Institute of Architects published a valuable book, "The Significance of the Fine Arts," a year or so ago, intended to make art in general and architecture more popular, and Mr. Magonigle's delightful and fascinating "Nature, Practice, and History of Art" has proved its worth as a source of inspiration.

The traditional architecture of the Old World should be made familiar to the pupils in our high schools, and some knowledge of the subject might easily be taught to children in the elementary schools.

We have in mind a little book, "Famous Buildings," by Charles L. Barstow, a "Primer of Architecture," that should interest not only children but some adults we know who haven't time to take up the topic "seriously." "How to Know Architecture," by Frank Wallis, is an admirable book to pass along.

No library is complete without Vasari's famous "Lives." He was a delightful Paul Pry in the artistic world of his time, and he knew the value of personalities and anecdote.

Our own architecture is of moment, be it said, and the charm and intimate quality of the Colonial, both North and South, should be emphasized in telling the story of George Washington, Jefferson, and the growth of our Republic.

And what of the present? How about the great cathedral that will sometime overlook New York from Morningside Heights? How about Cram, Goodhue and Ferguson's beautiful St. Thomas's? Goodhue's Chapel of the Intercession? Old Trinity? And how about the marvellous temples of trade and commerce in general, the Woolworth building, the million-dollar bank buildings, the Morgan Library, the Pennsylvania Station, the Harkness Memorial, the buildings at Princeton and others of our great universities? Our heritage is a rich one and we should better know its significance and the men who have left and are leaving it to us.

A Good Idea

THE annual award of prizes by the New York Fifth Avenue Association for the best new buildings and best alterations should have a salutary effect upon the public taste, and contribute to a better knowledge and understanding of our current architecture. To the average man in the street a new building means little beyond the fact that it has taken the place of an old familiar. In our cities the aspect of streets seems almost to change overnight.

There is continual tearing down and continual going

up. To-day a great gap in the ground, a blank space in a row of buildings, to-morrow something different.

In picking out new buildings for special notice and calling attention to the fact that they, in the judgment of those competent to say, are the best of the year, a service is done to the architectural profession as well as to the public.

Most of us need to have our attention called to particular things, if we are going to see beyond the horizon that limits our daily busyness. We are creatures of routine, and walk the streets day after day with our eyes on the main chance, as we imagine it, blind to a thousand things that might easily make life a lot more interesting.

In looking over the illustrations of the prize-winners in this issue, architects will naturally study details and discuss the reasons for the awards. It would be interesting to report the comment of the experts, and to listen to the varied opinions expressed.

Nothing can be perfect in this world and the different tastes among architects are as pronounced as the varying judgments that we may hear in a visit to the Grand Central Galleries, or the Metropolitan Museum.

The publication of these prize-winners in the newspapers is of great value. They are seen there by the public in general and, maybe, a few will take the time to look at the buildings shown and try and determine some reasons for their distinction.

We wish the prize idea might spread to every city and town in the country. Prizes, no matter how small, even the mere picking out of particular buildings for special mention by experts, calls attention to the fact that the work of the architect is something to be considered seriously.

Annual awards of this kind would in time have a tremendous influence for good in the way of educating public taste. And the deil knows that the public taste is something that needs a lot of steering.

We feel sure that few will find any fault with the selections in this particular case. Both the new buildings and the alterations are marked by conservatism and good taste, and may be studied with profit by professional and layman alike.

From the Orient

CALIFORNIANS are never fearful of trying new things and their architects are nothing if not courageous. Little things like earthquakes that would terrorize the inexperienced and make them pause are forgotten as they pass out there on the coast and new giants rise from the old wrecks in defiance of all that the future may threaten.

In the new Telephone building, San Francisco has her Woolworth tower. The building dominates the view from all sides and stands a prideful landmark for all California, and an eye-filling spectacle to the thousands of Easterners who are hurrying to the land of sunshine and flowers.

The building is strikingly original and in going to the Orient for the leading decorative motives, the architects have shown their alertness and sense of fitness.

China is only just across the Pacific and the stream of influence from the East has been for ages playing its silent part in the artistic currents of the great coast State.

Boldness of conception, complete indifference to traditional styles, a grasp of essentials in creating an effect, novelty in the use of ornament, these are qualities that give us pause.

Still a Shortage of Moderate Cost Housing

ALTHOUGH 1925 was a record-breaking year in volume of building construction for most sections of the country, the first ten months of the year exceeding the total of 1924, there is still a definite scarcity of suitable housing for persons of average means. The large volume of residential construction has not yet met the country's real housing need. City residential construction has been largely of higher-priced apartment-hotels and apartments of a speculative nature, and while suburban home developments of the colony type have been very active, they have too frequently been high in price or very inferior in quality. Farm homes, where the owner's individual taste prevails, show a tendency toward modern home improvements and home utilities in an increasing degree.

The general situation as to housing, however, is such as to call attention forcibly again to the great need for proper planning, sounder financing, and better construction of homes, a condition which the American Construction Council has repeatedly pointed out and already done much to remedy through its nationwide campaign for better building. Through this movement for better building, started by the Council several years ago, representatives of all the component parts of the construction industry, from investor, owner or tenant to builder and mechanic, are engaged in one of the most notable co-operative endeavors of a great industry ever witnessed in modern business to deal with its relations to the public. The Council is happy to state that these efforts are receiving the hearty co-operation of the leading branches of the construction industry, some of which, following its suggestion, have already taken up the problem for careful analysis and treatment from their respective angles. In the last analysis, however, the remedying of conditions demands that the public of the country, assisted by the intelligent leadership of the industry as a whole, must learn the essentials of right construction and then insist that they be put into practice.

The dominating type of building construction has varied for different sections of the country, depending upon local conditions, but aside from residential work, public improvements and utilities and commercial buildings have played a relatively large part for many districts. Institutional buildings have also been active.

Present indications point toward an increasing demand for industrial buildings and replacement or alteration of out-of-date buildings of commercial and other types. Building activity has been generally pronounced in outlying districts as well as in the large centres, a tendency which is continuing.

The 1926 Paris Prize Competition

THE first preliminary competition for the annual Paris Prize of the Society of Beaux-Arts Architects will be held on February 27, 1926. The Paris Prize entitles the winner to enter the advanced work of the Ecole des Beaux-Arts in Paris, and he also receives $3,000 for his expenses for two and a half years' residence and study abroad. Competitors must be American citizens and under twenty-seven years of age on July 1, 1926.

Application for circular should be made to H. O. Milliken, chairman of the Annual Paris Prize Committee, 126 East 75th Street, New York, N. Y.



THE REPERTORY THEATRE OF BOSTON.

J. Williams Beal Sons, Architects.



FOYER, THE REPERTORY THEATRE OF BOSTON.

J. Williams Beal Sons, Architects.



MAIN AUDITORIUM, THE REPERTORY THEATRE OF BOSTON. J. Williams Beal Sons, Architects.



BOX IN AUDITORIUM.



BALCONY OF ASSEMBLY HALL.

J. Williams Beal Sons, Architects.

THE REPERTORY THEATRE OF BOSTON.



LOUNGE IN CLUB BUILDING.



LOUNGE IN BASEMENT OF THEATRE.



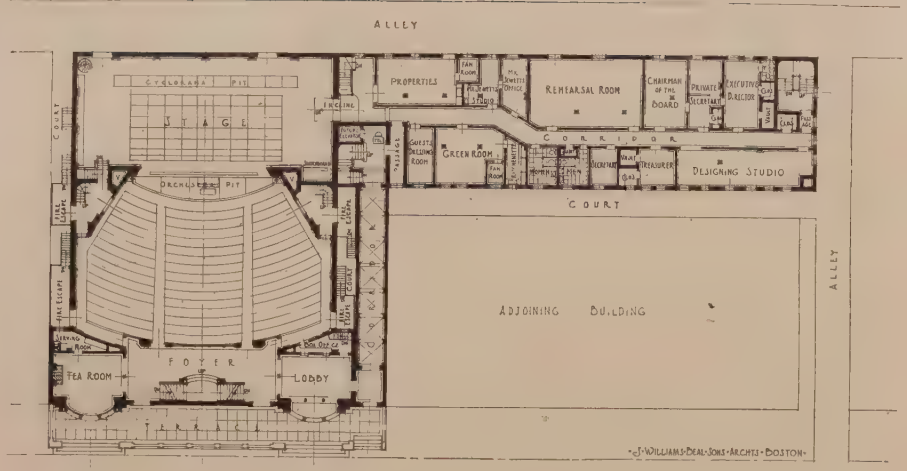
ASSEMBLY-HALL, TOWARD STAGE.



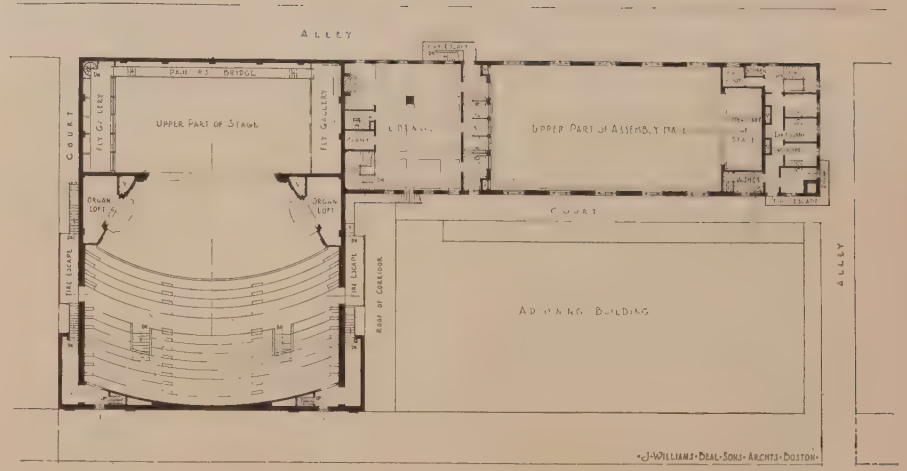
PROMENADE.

J. Williams Beal Sons, Architects.

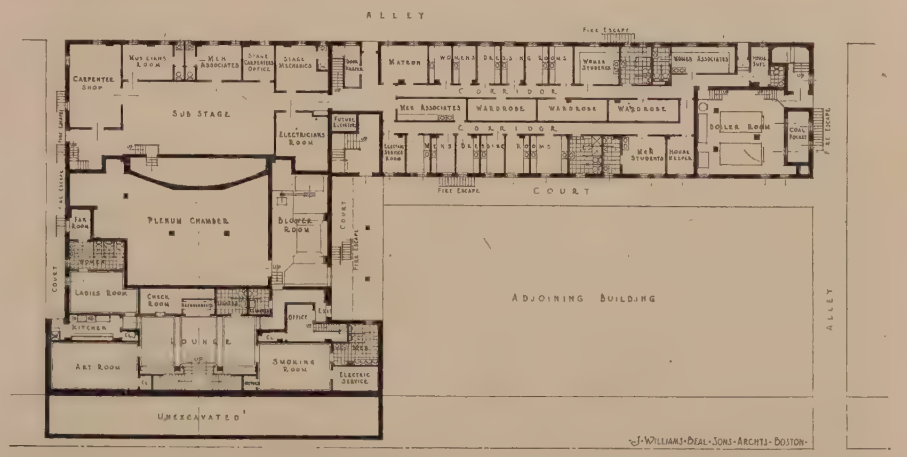
THE REPERTORY THEATRE OF BOSTON.



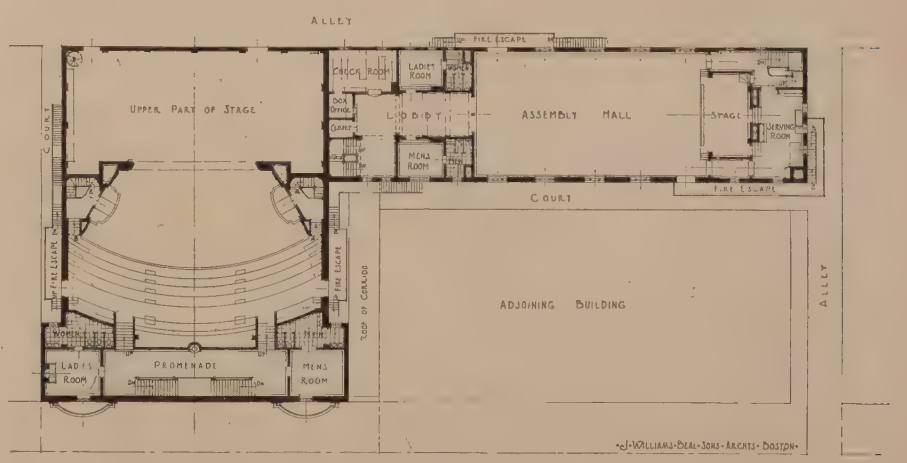
PLAN OF FIRST FLOOR



PLAN OF THEATRE BALCONY & SECOND MEZZANINE FLOOR OF CLUB BLDG



PLAN OF BASEMENT



PLAN OF THEATRE MEZZANINE & SECOND FLOOR OF CLUB BLDG

THE REPERTORY THEATRE OF BOSTON.

J. Williams Beal Sons, Architects.



Section A.

Section B.

Section G.

Section E.

Section C.

Section F.

Section D

Sash.

Transon Bar

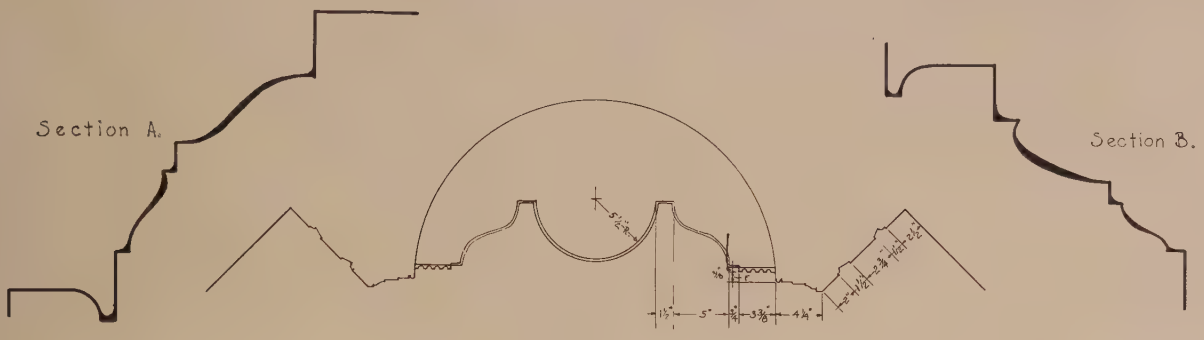
Note:- Pilaster bases missing.

Granite Steps.

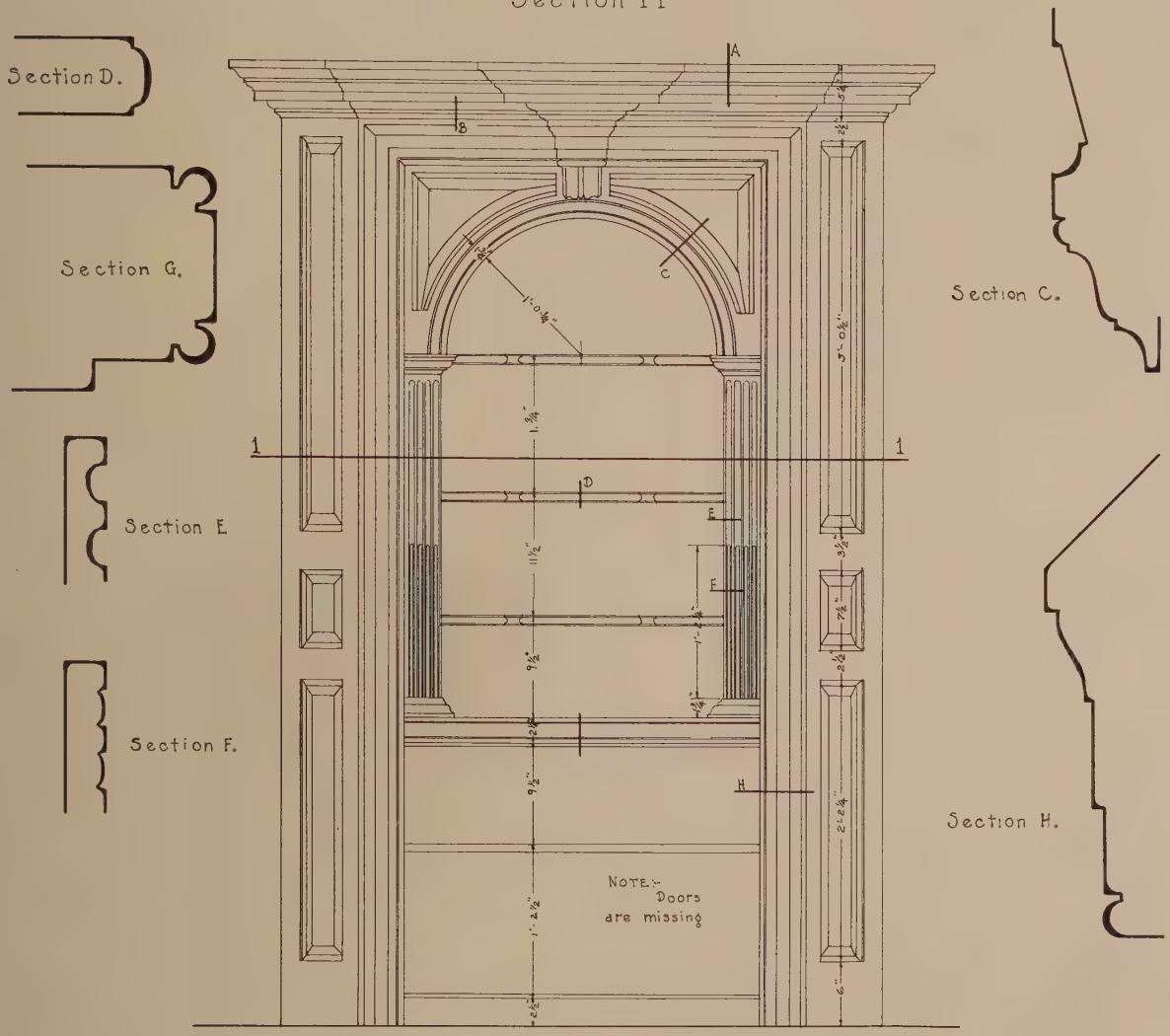
½" Scale Elevation.

Details one half full size.

MAINE COLONIAL SERIES	DOORWAY OF THE SPRAGUE HOUSE BUILT IN 1790. TOPSHAM, ME.	MEASURED AND DRAWN BY A. J. HARRIMAN II

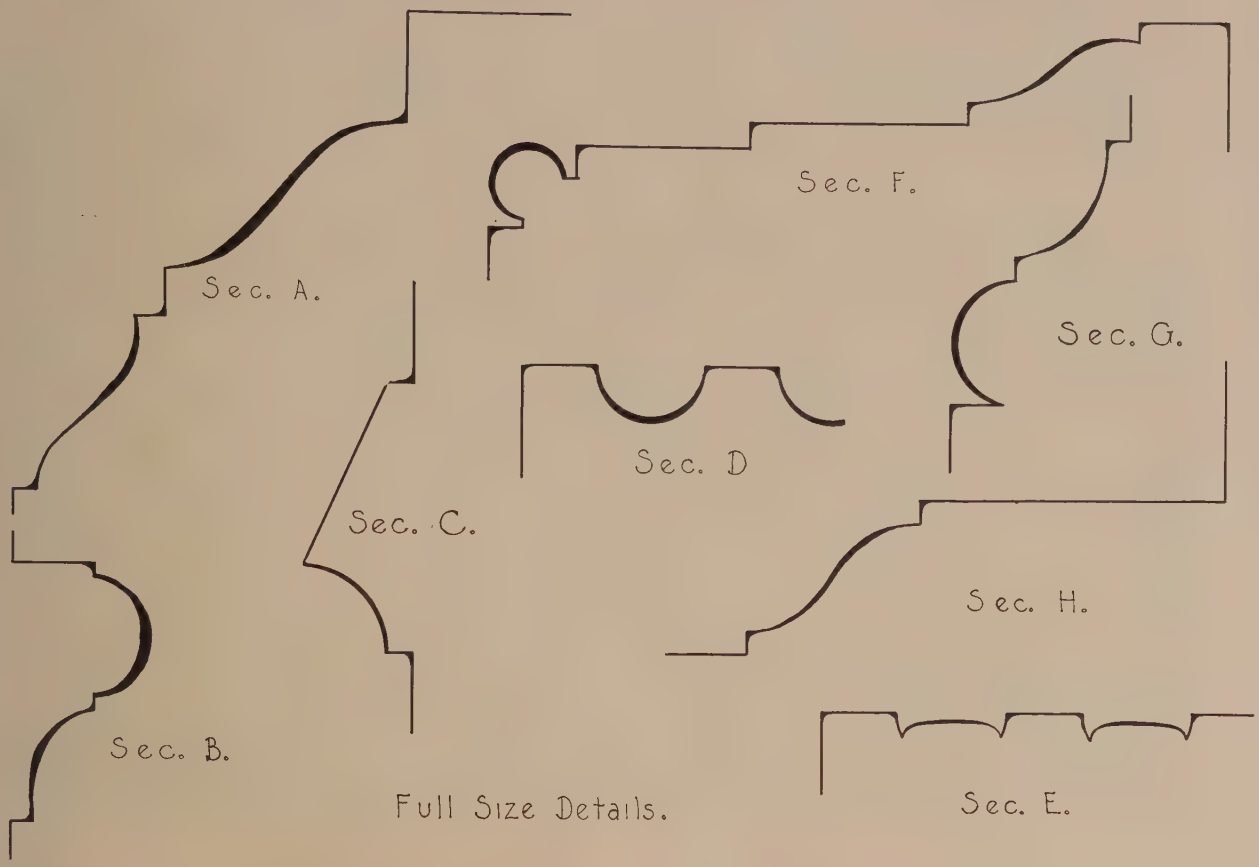


Section 11

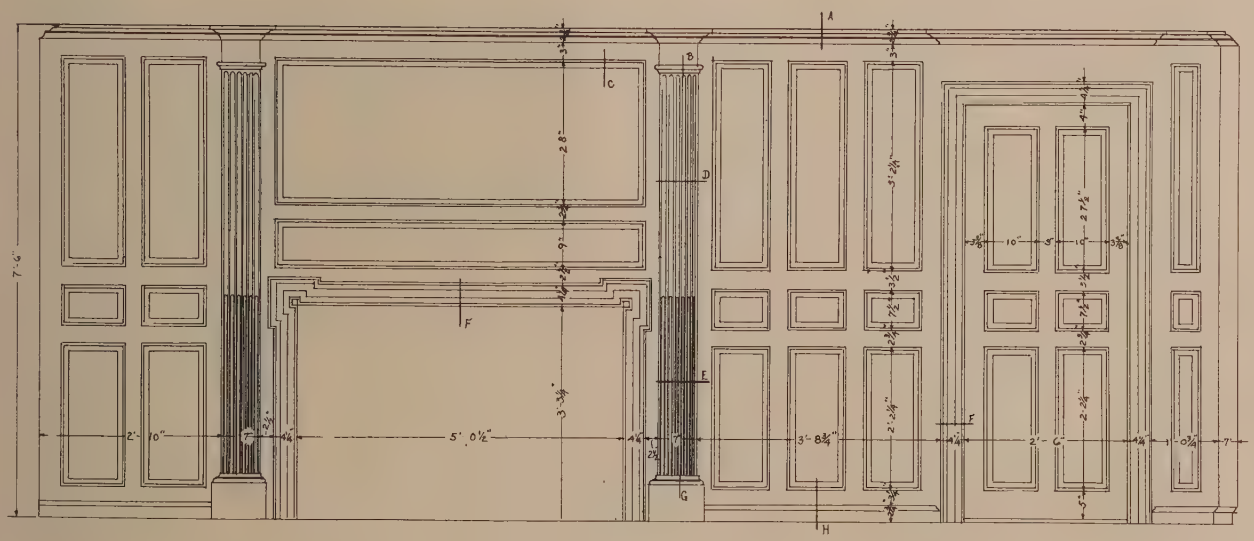


Elevation
Scale 3/4"=1'0.

MAINE COLONIAL SERIES	CHINA CLOSET OF THE SPRAGUE HOUSE BUILT IN 1790. TOPSHAM, MAINE.	MEASURED AND DRAWN BY A. J. HARRIMAN II



Full Size Details.



3/8" Scale Elevation of Paneling.

Maine Colonial Series	Paneling in the Sprague House Built in 1790. Topsham, Me.	Measured and Drawn by A. J. Harriman II



"REAR" VIEW.



THE MINNA STREET FRONT.

THE TELEPHONE BUILDING, SAN FRANCISCO, CALIF.
J. R. Miller and T. L. Pflueger, A. A. Cantin, Associated Architects.



MAIN ENTRANCE ON NEW MONTGOMERY STREET.



DETAIL OF UPPER STORIES.

THE TELEPHONE BUILDING, SAN FRANCISCO, CALIF.

J. R. Miller and T. L. Pflueger, A. A. Cantin, Associated Architects.



DETAIL OF MAIN ENTRANCE (SHOWING CHINESE INFLUENCE).

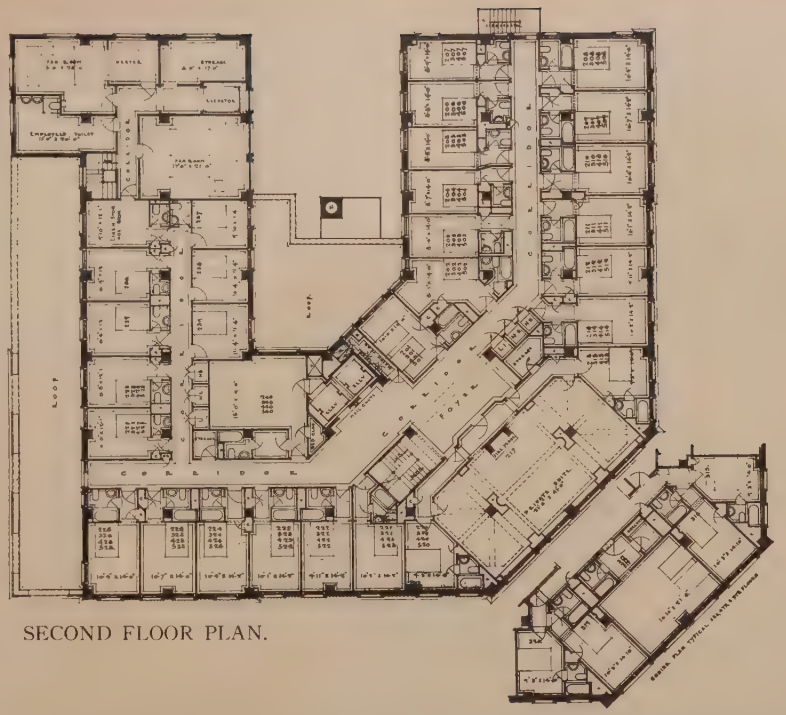


ELEVATOR LOBBY AND INTERIOR, MAIN ENTRANCE (CHINESE CORNICE AND CEILING).
THE TELEPHONE BUILDING, SAN FRANCISCO, CALIF.
J. R. Miller and T. L. Pflueger, A. A. Cantin, Associated Architects.

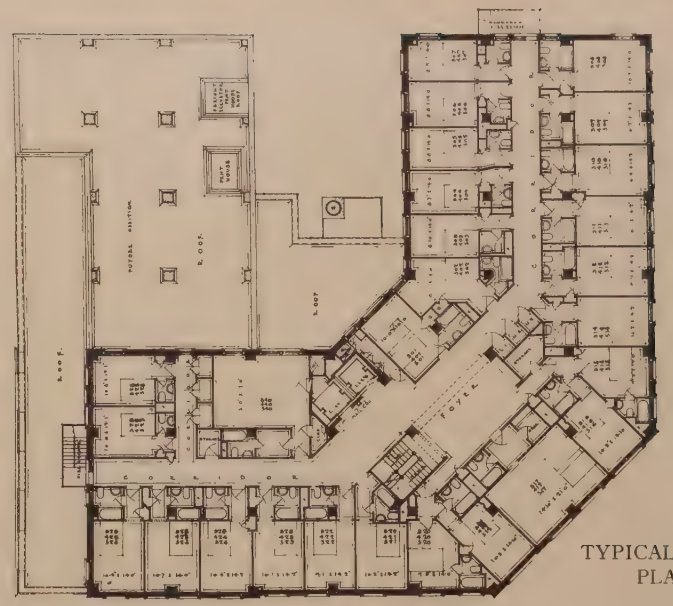


HOTEL LA FONTAINE, HUNTINGTON, IND.

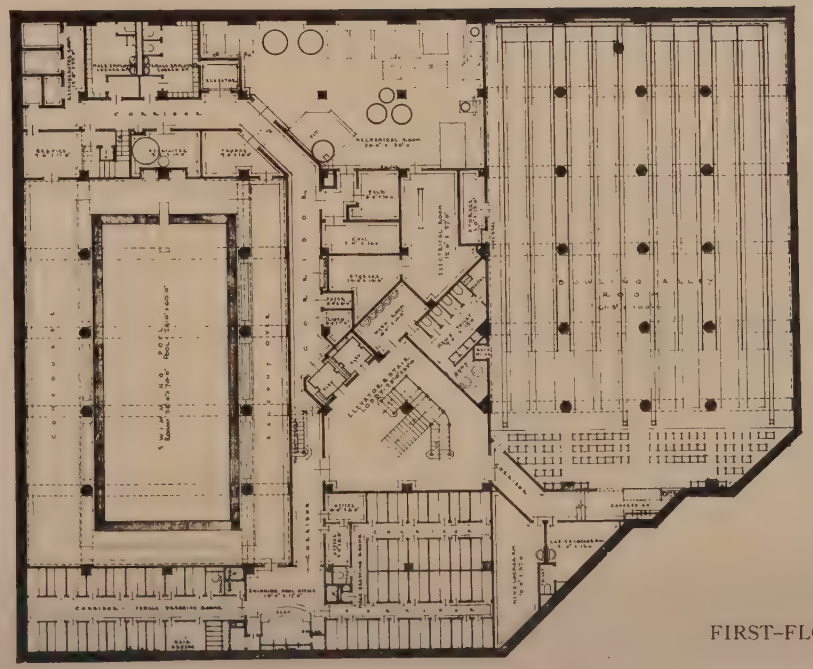
R. W. Stevens, Architect.



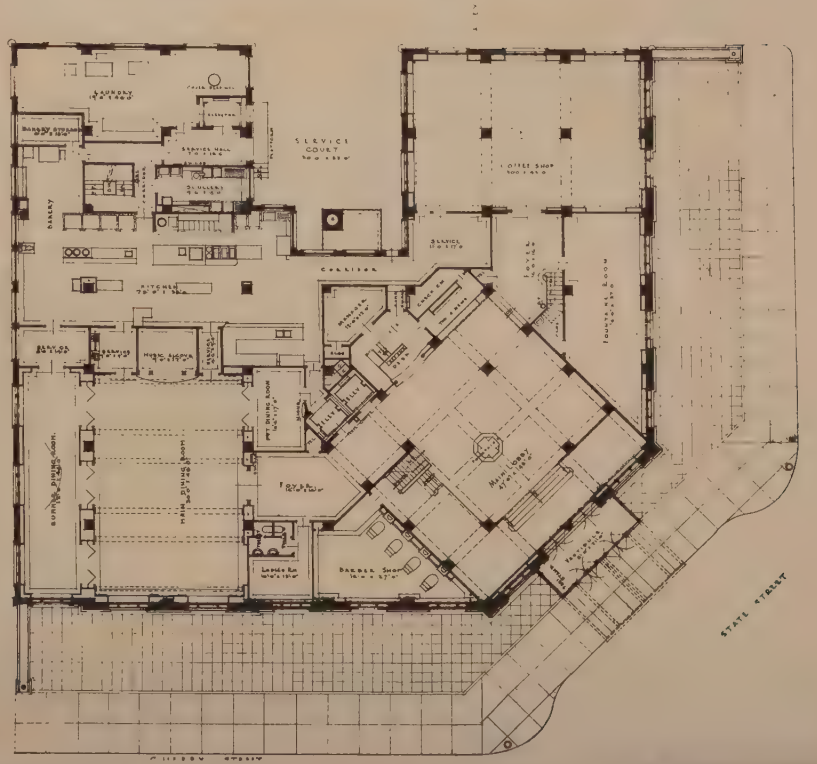
SECOND FLOOR PLAN.



TYPICAL FLOOR PLAN.



BASEMENT PLAN.



FIRST-FLOOR PLAN.

PLANS, HOTEL LA FONTAINE, HUNTINGTON, IND.

R. W. Stevens, Architect.



DINING–ROOM.



LOBBY.

HOTEL LA FONTAINE, HUNTINGTON, IND.

R. W. Stevens, Architect.



LOBBY, COFFEE-SHOP FOYER.

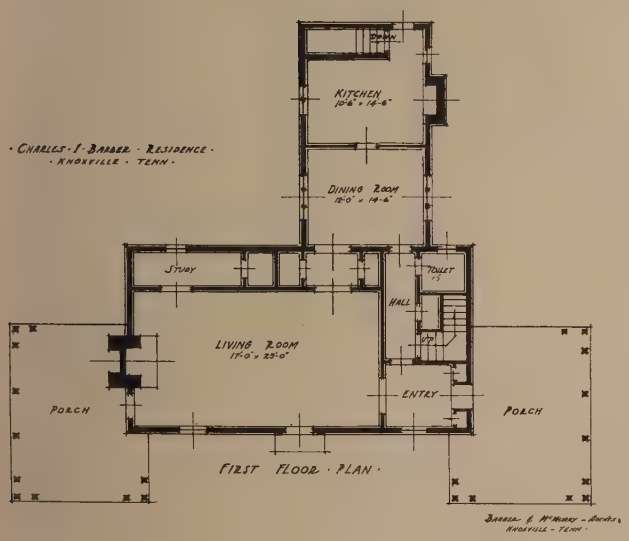


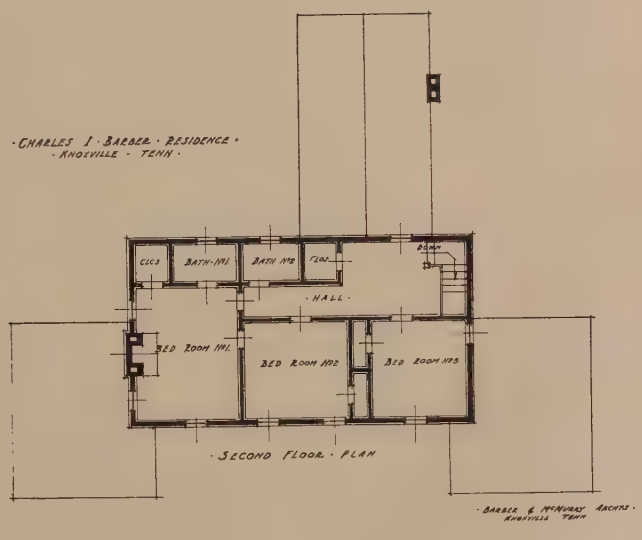
SWIMMING-POOL.

R. W. Stevens, Architect.

HOTEL LA FONTAINE, HUNTINGTON, IND.







HOUSE, CHARLES I. BARBER, KNOXVILLE, TENN. Barber & McMurry, Architects.



ENTRANCE DETAIL.



PORCH.

Barber & McMurry, Architects.

HOUSE, CHARLES I. BARBER, KNOXVILLE, TENN.



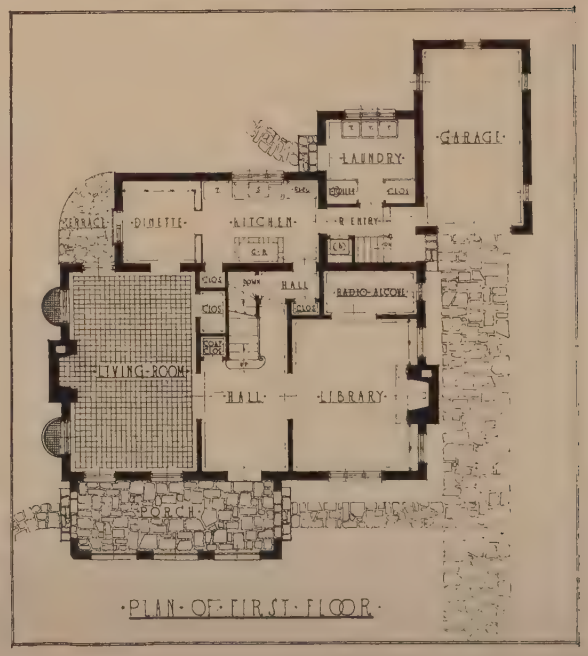
HOUSE, DANIEL H. VALENTINE, PALISADE, N. J. Granville W. Dexter, Architect.



HALL AND STAIRWAY, HOUSE, DANIEL H. VALENTINE, PALISADE, N. J.



PLAN OF SECOND FLOOR



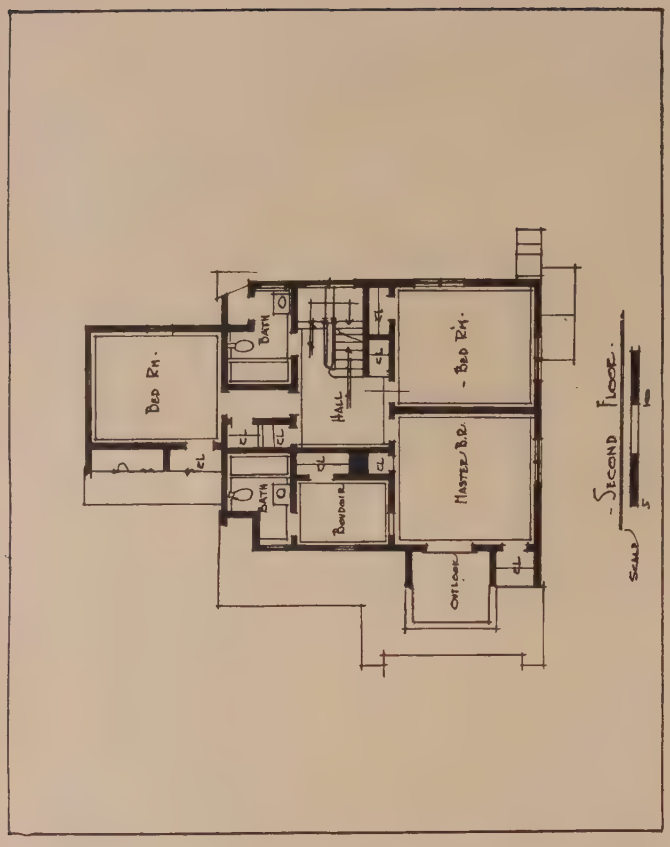
PLAN OF FIRST FLOOR

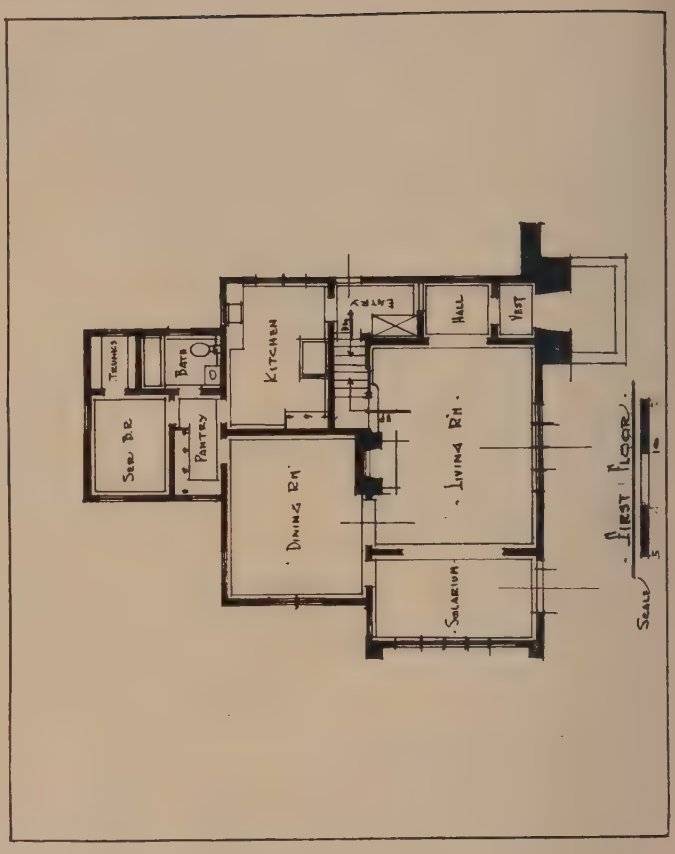
Granville W. Dexter, Architect.



HOUSE, ROBERT PUTNAM, LARCHMONT, N. Y.

D. A. Summs, Architect.


Bed Rm.
Bath
Hall
Bed Rm.
Bath
Boudoir
Master B.R.
Outlook
Second Floor
Scale


Trunks
Bath
Kitchen
Entry
Hall
Vest
Serv. B.R.
Pantry
Dining Rm.
Living Rm.
Solarium
First Floor
Scale





HOUSE, CASSANDRA A. STEIN, MT. VERNON, N. Y.



A BRICK HOUSE BASED ON THE DESIGN OF THE ONE ON PAGE 47

Comments on the Architectural League Exhibition, New York

By Alexander B. Trowbridge

President of the Architectural League, New York

THE annual exhibition of the Architectural League of New York, which opened with a reception on Friday afternoon, January 29, is not emulating the exhibition of a year ago, which was held at the Grand Central Palace. At that time the League, in co-operation with the American Institute of Architects, secured material from all sections of the United States and from foreign countries. In addition, there was a very comprehensive showing of the product of tradesmen in industries allied to architecture. Last spring's exhibition was one of the most successful and most widely advertised affairs ever held under the auspices of the League, but it should be obvious that such attempts cannot be made annually. And so, the exhibition of this year resembles more accurately the shows that have been carried out in the Fine Arts Building in the past. It is perhaps proper to accentuate at this point the fact that the name of the organization is slightly misleading to those not entirely familiar with its scope. While it is called the Architectural League, it is not confined in its membership to architects, but has as members a large number of painters, sculptors, landscape-architects, craftsmen, designers, and architectural engineers.

The selection and hanging juries always have a difficult task, as a great deal of work has to be done in a very short time. The juries this year met for the first time on the morning of Thursday, January 21, and the committees that were assigned to the task of awarding medals in architecture, painting, sculpture, landscape-architecture, and artistic craftsmanship met on the afternoon of Monday the 25th. To the visitor on the morning when the juries first got together for their task of selection, it looked as though a tremendous amount of material was available, and as if there would have to be a considerable portion discarded because of space limitations.

This organization fills a certain niche in the artistic life of New York and of the country at large which is apparently filled by no other society. Through it the workers in the various fields are enabled to place before the public the experimental and executed work which they have been carrying on during the preceding year. While it is evident that the general tendency of the League exhibitions is conservative in character, nevertheless innovations which are based upon sincere efforts toward the production of personal, original work are welcomed. This is noticeable in all of the sections of the exhibition. Among the decorative exhibits are many pieces of Batik textiles and other types of painted and dyed fabrics. Mural paintings of large dimensions give a touch of warmth and color to an exhibition which otherwise might be drab and dull in its outward aspects. In sculpture there are a number of interesting productions to be seen, varying from the preclassic work which has been inspired by men like Mr. Manship to a pair of panels which look as though they might have been suggested by details from an old Gothic cathedral. Beautiful examples of wrought metal are shown, and of course it goes without saying that the architectural section itself contains a great variety of buildings, from the lowly bungalow to the loftiest of modern skyscrapers. The University of Pittsburgh is shown in the form of a single towering structure. The new Telephone Building is shown in some strikingly interesting photographs of the exterior in perspective. Examples of work done in foreign countries by New York architects and many beautiful specimens of residential architecture are shown in plan and elevation, in photographs and in models. Landscape-architecture is exhibited through drawings, photographs, and models. In short, the scope of the exhibition is as wide as the subject would make it seem.

These exhibitions are always of intense interest to the architectural student and draftsman, for here, in one comparatively small area, may be found some of the most striking examples of architectural draftsmanship which the country has ever known. Among other things is a complete exhibit of the competition for the Roosevelt Memorial, which was won by the office of John Russell Pope. One of the innovations is a church with gigantic pointed arches on the interior, formed in reinforced concrete, the thrust of these arches being taken by buttresses on the exterior, built in cut stone. The effort is certainly original and may prove to be very impressive.

The professional men who read these brief comments will be interested to know that the League exhibits have a distinct appeal to the lay public, and during the four weeks in which this exhibition is open, at 215 West 57th Street, there will be a steady attendance on the part of interested men and women who are contemplating some sort of adventure in the architectural field. A catalogue, profusely illustrated, is published in connection with each of these exhibitions, and this year's catalogue is quite up to the standard of previous years, being full of interesting and valuable material.

It is a good thing for architecture and the allied arts to be compelled, through circumstances, to appear on dress-parade annually; to take account of stock and bring forth the best efforts of the past year in the most attractive form for presentation to the public. It is not unlike the often-quoted value to architects of a well-conducted competition. In spite of the fact that competitions have many features which are disliked by the profession, it is undoubtedly true that they stimulate the men who are engaged upon them and bring out the best that is in them in the fields of planning, designing, and presentation. In the same way, while the problem of preparing for a League exhibition causes the architects, painters, and sculptors considerable trouble and expense, it is compensated for by the fact that each one of the exhibitors learns something from all of the others, since each is putting his best foot forward.

Acoustics—Sound Reflections

Dead Spots—Reverberation—The Use of Wires—Some Common Fallacies

By George C. Hannam, M.E.

SECOND ARTICLE

Echo

ECHO is a special case of reverberation. Ordinarily the prolongation of a sound after the source has ceased vibrating is continuous until it becomes inaudible. When the sound, instead of being maintained, is short and sharp, with a noticeable interval between the direct sound and the reflection, an echo is produced. It is necessary in the case of the average ear for the time interval to be greater than one-twelfth of a second. Professor Watson, of the University of Illinois, in writing about the acoustics of the University auditorium, mentions an interesting condition that developed during a concert being given by the university orchestra. The number was a xylophone solo with orchestral accompaniment. The echo was so pronounced that at one time the leader of the orchestra beat time to the echo, whereas the players who were immediately around the xylophone kept time to it. Those farther away kept time with the leader, and the resulting confusion can well be imagined.

Curved surfaces should be avoided in the design of an auditorium as far as possible. When used, the centre of curvature should be located a considerable distance from the location of seats. The harmful effects produced by a dome, curved ceiling, pendentives, etc., cannot be entirely overcome by acoustical treatment because such surfaces cannot be made totally absorbent. Surfaces covered with felt one inch thick will absorb 53 per cent of the sound energy striking it. Forty-seven per cent will still be reflected, which is sometimes sufficient to be a source of complaint.

Interference

So-called "dead" spots in an auditorium are caused by interference. A body in vibration sends off a wave of condensation, which is immediately followed by a wave of rarefaction. As long as the vibration continues, these waves follow each other. Should sound waves travelling by different paths come together again, the condensation wave of one will meet the condensation wave of another, causing the sound at this place to be reinforced; or, should one path be slightly shorter than the other so that the condensation wave of one meets the rarefaction wave of the other, there will at this point be no sound.

An interesting example of this phenomenon is the tidal interference observed on the Tongking Peninsula in Asia. The tide of the Pacific Ocean enters the China Sea through two channels. One of these channels is broken up by many small islands, which force the tide in going through to follow a tortuous course, greatly retarding it. The other channel is short, deep, and practically unobstructed, causing but little retardation. The tide coming through these two channels produces an effect which varies from place to place. At one port on this peninsula the tide coming from one channel is just six hours later than the tide from the other channel. It is, therefore, high tide from one when it is low tide from the other. As the two tides are equal in size, they neutralize each other so that there is no change in the water-level.

Reverberation

Of acoustical defects, the most common is excessive reverberation. A sound produced in a confined space will travel from surface to surface until it is either transmitted by the walls, or is transformed into some other form of energy, generally heat. This process is called absorption. The duration of a sound after the source has ceased vibrating is called reverberation. When the duration of audibility of the standard sound used exceeds the ideal amount, the reverberation is excessive. By using the formula developed by Professor Sabine, it is possible readily to determine the reverberation for any room from the plans. From experience I know the desirable reverberation in various sized rooms used for different purposes, and can readily figure by means of the same formula the number of sound-absorbing units it is necessary to introduce to obtain this condition.

In the average room used only for speaking, when the volume is approximately 150,000 cubic feet, the reverberation under average audience conditions should be not more than 1.9 seconds, nor less than 1.3 seconds. For most forms of music it is desirable to have the reverberation exceed 2.1 seconds. When a room is to be used for both speaking and music, it is usual to compromise, having the reverberation slightly excessive for ideal speaking conditions, and slightly less than that demanded for ideal musical conditions. The solution can be varied, of course, to suit the special conditions presented by each case.

As the volume increases it is necessary to increase the duration of reverberation. Unfortunately, a reduction in the reverberation produces a corresponding reduction in the intensity. For this reason, in a room having a volume of say 400,000 cubic feet, it would not be advisable to reduce the reverberation below 2.7 seconds. This duration of reverberation is slightly excessive for an untrained speaker, but necessary to insure sufficient intensity in the furthermost parts of the room.

A Reverberation Problem Worked Out

To illustrate the method of calculating the reverberation and the determining of the area of acoustical treatment required, I will take the case of a court-room, 60 feet wide, 100 feet long, and 20 feet high. The following assumptions are made:

Floor, concrete.
Side-walls, plaster on tile.
Ceiling, plaster on metal lath.
Area of glass windows, 500 square feet.
450 seats.
Correct conditions desired, when 70 persons are present.

Sabine formula for reverberation is:

$$r = k\frac{V}{a}$$

where r equals reverberation in seconds; V equals volume in cubic feet; a equals open window units of sound absorption; k is a constant and is .05 when foot-second units are used. A sound is used having an intensity of 1,000,000 times the minimum audible intensity and of pitch one octave above Middle "C" on the piano.

U OF I
LIBRARY

Area concrete floor 60′ × 100′ = 6,000 sq. ft.
Coefficient of absorption of concrete is .015.
6,000 sq. ft. × .015 = 90 units.
Area side-wall surfaces
(60 + 60 + 100 + 100) 20 = 6,400 sq. ft.
Area of glass windows = 500 sq. ft.
Net area plaster on hollow tile = 5,900 sq. ft.
Coefficient of plaster on hollow tile is .025.
5,900 sq. ft. × .025 = 147.5 units.
Area of glass, 500 sq. ft.; coefficient .027.
500 sq. ft. × .027 = 13.5 units.
Area of ceiling 60′ × 100′ = 6,000 sq. ft.
Coefficient for plaster on wire lath is .033.
6,000 sq. ft. × .033 = 198 units.
450 seats, coefficient .1.
450 × .1 = 45 units.
70 persons, coefficient 4.7.
The coefficient for one person is taken at 4.6 due to the fact that the chair occupied by each person has already been considered at .1, and when occupied its value as a sound absorber is almost nothing.
70 persons × 4.6 = 322 units.
Total number of units, 90 + 147.5 + 13.5 + 198 + 45 + 322 = 816.
Volume of room 60′ × 100′ × 20′ = 120,000 cubic feet.

Substituting in formula $r = k\frac{V}{a}$, the following results are obtained:

$$r = .05 \times \frac{120{,}000}{816} = 7.34 \text{ seconds.}$$

Experience has shown that the ideal reverberation for a court-room of this size is 1.5 seconds. A reverberation of 7 seconds is very excessive, and it would be difficult, if not impossible, to hold court in such a room. An increase in the number of persons present will accomplish a reduction in the reverberation due to the additional clothing introduced. The reverberation can readily be determined for all audience conditions.

Substituting 1.5 seconds—the ideal reverberation—for r in the formula, and solving for a, we get:

$$1.5 = .05 \times \frac{120{,}000}{a}$$

$$a = 4{,}000.$$

This shows that 4,000 absorptive units are required in the room to have a reverberation of 1.5 seconds. There are 816 units already in the room, so that 4,000 − 816 = 3,184 additional units which are required. These additional units can be supplied by means of acoustical treatment, which consists of felt, usually one inch in thickness, fastened to certain of the available surfaces of the room. The felt is concealed by tightly stretching a cloth membrane one inch away from it. The cloth is painted or dyed the desired color. Only special paints can be used for this purpose. Each square foot of treatment has a coefficient of .53. Dividing the number of additional units required, 3,184, by the coefficient of absorption for each square foot of felt, .53, we get the number of square feet of treatment required, namely, 6,007 square feet. The ceiling area is 6,000 square feet, so that treatment applied to this surface will accomplish the desired results.

Wire Stretching

I am frequently asked regarding the value of stretching wires to overcome acoustical difficulties. The fact that they have been used so extensively misleads most persons into believing that beneficial results can be thereby obtained. There is no theoretical basis for their use, and to my knowledge there is no place where any improvement in the acoustics of any auditorium has been brought about by stretching wires in any shape, form, or manner.

It is claimed, *e. g.*, that wires radiated from above a speaker's head to parts of the room will assist in carrying the voice to locations where it would otherwise be difficult to hear. A knowledge of the fundamentals of sound enables one to see that this is an impossibility. A wire can only be stretched so as to be in tune with one note. It is, moreover, only possible to impart a microscopic vibration to the wire which is not audible. If the wire were connected in the proper manner to a relatively large sounding board, it would be audible. Even if it were possible to obtain the desired vibration, it would be a decided disadvantage because an undue prolongation of each sound would be produced. It is desirable in both speech and music to have each sound absorbed quite rapidly so as not to interfere with the proper hearing of succeeding sounds.

Sometimes it is claimed that an echo can be broken up by stretching wires in front of the offending surface. Experience proves this cannot be accomplished. The sound wave, due to its large wave front, passes through the wires, with practically no change. The action can be studied by watching an ocean wave pass through a row of piles spaced at various intervals. There is some disturbance noticeable at the piles, but a few feet beyond the wave presents a united unbroken front.

The reason for the misunderstanding regarding the use of wires is probably due to the fact that they have been used for years as a means for support of flags and bunting for decorative purposes. An improvement in the acoustics has frequently been noticed, and the credit for the change has been given to the wires instead of to the flags and bunting. It is simply the presence of additional sound absorptive materials, placed usually in a particularly desirable location, that causes all sounds to be absorbed more rapidly, thus reducing the period of reverberation or making a surface almost totally absorbent, which otherwise would produce an echo.

I know a court-room where wires were stretched the length of the room and connected with cross wires that were attached to ventilator grills. The clerk of the court told me they thought the undesirable reverberation would be carried by the wires to the ventilators and then out of the room by the current of air. "It seems plausible," he added, "but unfortunately it doesn't work."

Other Fallacies

There are many features of the design of a room that are erroneously blamed for the faulty acoustical conditions. A suspended ceiling, *e. g.*, is thought by some to be set in vibration by the sound waves, thus producing the undesirable reverberation. While making an examination of a council chamber, I was told by the Board in charge that they thought the trouble was produced by the barrel vault ceiling, which, due to the suspended construction, was set into vibration by the sound waves. They showed me bags filled with sand which they had placed on top of the ceiling to stop the supposed vibrations. No benefit was obtained. The force of the sound waves produced in this room was actually too feeble to produce even a microscopic vibration. The trouble was due to the use of hard, fire-proof building materials, without the introduction of sufficient sound absorbing materials to neutralize their effect.

The Telephone Building, San Francisco

Novel and Original Decorative Details from the Orient

J. R. Miller and T. L. Pflueger, A. A. Cantin, Associated Architects

By J. S. Cahill, Architect

A TWENTY-SIX-STORY building, 150 by 160 feet, rising 436 feet from sidewalk to base of flagpole, with nearly six acres of exterior wall surface, and costing four millions of dollars is, in itself, an architectural event of the first magnitude.



"Rear" view from The Mission.

Seen from the Bay, this new building completely dominates the sky-line of San Francisco, and, although somewhat to the south of the city's main mass, it holds its own in silhouette by sheer bulk, towering above all other buildings as well as the hills behind and the buildings on those hills also!

Throughout the entire structure there is scarcely a trace of school tradition. Early "studies" of the architect reveal hints of Gothic influence. But these faded out completely as the design neared maturity, and, of all the definite historical styles extant, this building shows a frankly expressed trace of only one, and that, strange to say, is Chinese!

The conception of the whole building is daringly original. The minutest details are worked out with deliberate and consistent logic.

The Telephone Building exhibits an economical, thinly spread use of inexpensive material worked over, however, into daringly original architectural forms, characteristic of the bold initiative of capital created by invention. It is the genius of the inventor that has made the telephone what it is to-day. It is quite natural, therefore, that the representatives of the telephone enterprise should look for and encourage creative invention in their architect. And without confidence and patronage of the owner, the genius of the architect cannot possibly be revealed.

It may be laid down as an axiom that, on a tower building, all sides are fronts. That is to say that above the roof line of surrounding blocks the word "rear," "front," "side," or "back" ceases to have any meaning. All boundaries are of equal importance.

The surface treatment of this building is the most remarkable thing about it, for, as we shall see, it is original and unique to a degree without precedent or parallel in modern work, as far as the writer's knowledge extends.

The whole building is divided into nine structural bays on the entrance front and eight on the side-streets (when completed). Each of these structural bays is divided into two window-spaces by a secondary narrower mullion pilaster midway between the wider pilasters which follow up the steel columns of the frame. Seven central bays on the front and six central bays on the side define pavilions very slightly in advance of the corner bays. They continue on the elevation sheer to the top of the building with a 9 feet 6 inches regression, however, over the twenty-second floor, which, by the way, is an extra-high one. The end bays on both façades, forming the slightly setback corners, extend vertically as far only as the eighteenth floor, where the square corner "panels" which they define (in plan) terminate in a deck with square-topped parapet walls. These square corner bays do not belong to the main body of the building, considered as a design. This fact is indicated at the outset in the shape of the three pilasters enclosing them, for their faces are flat in plan, whereas the pilasters of the central pavilions are all convex on the face with a reversed ogee curve to each corner, in plan like a section through the back of a violin. The re-entrant angles of the main pavilions are now revealed from the eighteenth floor up clear to the top. We see them as solid-looking clustered pilasters forming great holding pylons at the four corners of the main turret of the building. In horizontal section each shows twenty running feet of solid masonry from the jamb of one window to that of the next around the corner. This creates a splendid sense of strength and makes at the same time a striking foil to the superfenestration of the walls between.

The effect of cross-bands of masonry at harmonic intervals to impart organic subordination to the design is brought about by repeating the vertical lines of light down the fronts of the windows by an interpolated row of columns. These are engaged to the walls between window-head and sill, and pass in front of the windows in places as free columns or stems. These again, as they mount, carry screens of bifurcating tracery with finials and enfoliations repeated and diversified at rhythmic intervals until



Directors' Room.

they emerge in the final cresting which forms the sky-line of the building.

In this design we are prepared for a strange interpolated system of decoration, which reaches full expression at the top of the building by being introduced to part of its mechanism almost at the bottom. Over the main doorway and clear across what we may call the base of this building, in fact, defining it as such, there is carried a band of pseudo-solidity by repeating between the sill and head of each window a row of sconcelike stems or engaged columns; each with pendent and finial extending above and below the windows of the third and fourth floors respectively. This device not only marks the first stage of the great ascent by a bold horizontal belt of interest, but announces and familiarizes us with a motive of great importance which we shall meet with again and yet again.



Detail of cornice.

At the twenty-first floor, which is an extra high one, the windows around the building have semicircular heads and this seems to portend another change. For the fourth time these interpolated columns or stems appear at the window-heads, and at the twenty-second floor, a still higher story, they can no longer be suppressed, but shoot boldly up in elegant tapering and detached shafts, right in front of the windows toward the heads of which, after sending down a grillage of herring-bone branches, they finally open out into bold triple finials of a giant Gothic gable. These, carried all around between the plain piers which here abruptly end, combine to form the crested parapet of the second regression, where the three advanced pavilions of the street fronts now terminate. The piers now continue up the main inner turret through two more stories to the twenty-fifth floor, where the windows are not only arched, but carried in effect through both floors in one recess without masonry dado to divide them at the floor and sill levels.

As an example of knowledge, restraint, and reasonableness, attention is drawn to the handling of the main entrance. The fine dignity of this great symbolic portal, in its simple proportions (exactly 20 feet wide by 40 feet high) and absolute harmony with its surroundings, shows a breadth and bigness of treatment which can only be described as masterly. The sheer simplicity of the splayed opening, with not a single extraneous feature to help it, other than the motives of the building itself, is cleverly contrasted with the elaborated screen of perforated masonry over the doorway, foretelling in miniature the giant screens above. All this, while so easy to look at, is, without precedents to work from, quite difficult to design.

Five is the mystic number of the Flowery Kingdom, and at the fivefold bronze doorway itself, with its five-part arch-heads so oddly ornamented, we come to the first traces of Chinese influence, which is such a surprising reaction to the absence of any definite style throughout the rest of the whole exterior.

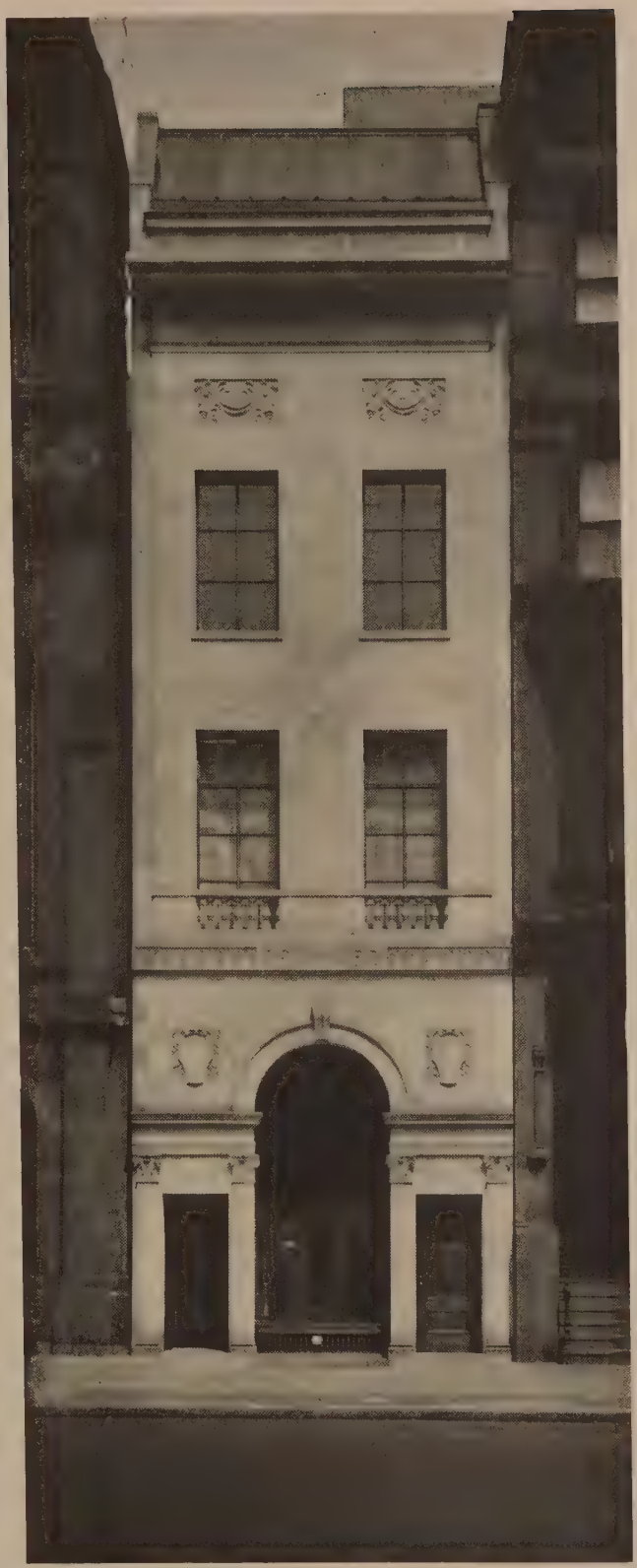
The walls of the elevator lobby are, like the exterior, devoid of horizontal lines, not even door-heads or sills, for all openings are uniformly framed in bronze clear to the ceiling, with high rectangular panes of figured glass, which give at once a sense of unity and a loftiness which mere feet and inches would deny. By this interception of high openings, the wall surfaces become a series of broad pilasters reaching clear to the ceiling. They are of tawny black polished marble, in which waves upon waves of gilded veinings follow one another up and up until they seem to break in a polychrome cornice of billowy mouldings which spend themselves on the ceiling in foaming spindrifts of wavy gold. The ceiling itself is frankly and splendidly Chinese, with grotesque parades of heraldic monsters incised in a field of faded coral and burnished in pale bronze—the bronze of the grilles, the windows, and the doors. The effect is at once strange, restful, gorgeous, and yet severe. It typifies the rich redundant Orient disciplined to Occidental purposes, and suggests many things besides.

We see here new architectural possibilities in the enormously rich offerings of China, India, Burmah, and Japan; colorful, gorgeous, and of inconceivable variety. Considering how the Greco-Roman and Renaissance inheritance has been exploited to the point almost of weariness, it is encouraging to think of the illimitable fields of inspiration lying petrified and unknown to us, in the temples and palaces of Asia. American architects are the world's masters in the art of creative eclecticism. In fact, American architecture is little else. Now that we have practically drained the western half of the Old World of its recorded art forms there still remains the East of the Old World to draw from, a far richer field in its bewildering accumulation of the raw material, if not the finished products of design. Our architects now tour the whole round globe where formerly they stayed in France. All that is needed is for our publishers to give us reproductions of Asiatic architecture, a field unduly neglected even by the Germans.

It is safe to say that the new Telephone Building is a complete surprise to the architectural profession and a positive delight to the public at large.



Gold Medal and Diploma.
First Prize, New Buildings.
Steinway Hall, 109 West 57th Street, New York.
Owner, Steinway & Company.
Architects, Warren & Wetmore.



Gold Medal and Diploma.
First Prize, Altered Buildings.
Brummer Building, 27 East 57th Street, New York.
Owner, Joseph Brummer.
Architect, I. N. Phelps Stokes.

1925 ANNUAL ARCHITECTURAL AWARDS. THE FIFTH AVENUE ASSOCIATION, INC., NEW YORK.



Silver Medal and Diploma.
Second Prize, New Buildings.
The Macmillan Building, 60 Fifth Avenue, New York.
Owner, The Macmillan Co.
Architects, Carrère & Hastings.



Silver Medal and Diploma.
Second Prize, Altered Buildings.
Gerli Building, 49 East 34th Street, New York.
Owner, E. Gerli & Co.
Architect, Arthur J. Barzaghi.

The Effect of Gravity on Building Construction

By H. Vandervoort Walsh
Professor of Construction, School of Architecture, Columbia University

ARTICLE VI

REVOLVING ACTIONS, THE NEED FOR A HIGHER SYSTEM OF REASONING, AND A SUMMARY

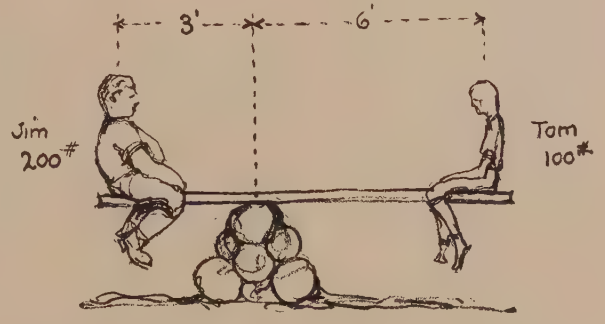
A BULLET is shot from a gun as the exploding powder expands and forces it ahead. An arrow flies from the bow as the string is snapped back by the elastic ash. The ball goes on a long trip to the outfielders as the great batsman swings his bat against it. The stone flies from the sling as David aims it with skill at Goliath. Yet the bullet, the arrow, the ball, and the stone sent flying in the air by a force do not travel in a straight line, but drop gradually in a great curve downward to the earth. How is it, then, that Newton gave us the picture of a body travelling off in a straight line when it was impelled by a force, for such observations do not bear him out? Well, of course, if we stop to think a little further, we will realize that these projectiles were not operated upon by one single force, but were also influenced by the action of gravity. Always this unseen pull is operating to drag things down to the earth. If we let this force work alone, however, upon a falling stone, it will make the stone drop in a straight line, and it is here that we see the true picture of a single force impelling a body in a straight line. Indeed, you may recall the fable about the apple which fell on Newton's head and knocked this idea into it.



His job is to keep the objects at the bottom under those at the top.

If you play billiards, you will know the truth of the statement that a body travels in a straight line, after a force has struck it. On a very level table, like the billiard-table, all of the balls are equally indifferent to gravity, and so they can be pushed, with a blow from the cue, in a straight line. Indeed, architects ought to be made to play billiards for the lessons which they will learn about the action of forces. The antics of the balls will afford many examples of the action and counteraction of forces. Strike the ball a blow with the cue, and one can feel the ball strike back before it starts away, just as the departing bullet from a gun kicks back the gun on its carriage. Send the ball rolling across the table to bump the edge at an angle, and it will rebound at the same angle at which it struck the side. And here is a nice little problem upon which to try out the theory of the triangle of forces. If the ball is pushed with a 50-pound blow and strikes the table edge at 30 degrees and rebounds at 30 degrees, at what angle did the edge strike at the ball, and what was the size of the blow in pounds? Notice here is a ball travelling in a certain path, impelled by a force of 50 pounds, and it encounters another force which changes its path, and the location of this path we know from observations. That is all we will suggest. Try it and see whether you do understand what is meant by the principle of the triangle of forces. It is one thing to have understood this principle when it was stated, but another thing to know it so well that you can apply it to various conditions and reason about them.

But it is not often that we see forces acting in such simple ways as to cause bodies to move in straight lines. Of course, when we build columns in upright positions in a building, we recognize the fact that all of the particles are *desirous of moving down to the earth in a straight line*, but they cannot because there are other particles in the way. It is something like a jam of people crowding down a straight runway, during the rush hour in the subway. The ones at the rear of the line may be desirous of moving forward and may be pushing that way with all their might, but they do not move, because some poor guard has slammed the door and stopped the line. Just so, the earth upon which the building and columns stand has blocked the downward movement of all of the particles of which the building is constructed, just as the doors stopped the onward movement of the crowding line. But if you have ever been between the closed doors and the onward pushing crowd, you will appreciate that the longer that line of pushing humanity becomes, the more awful is the pressure on your ribs, even though with all this exertion no one gets ahead. In the same manner the poor little particles of rock and earth under the



200 × 3 = 100 × 6

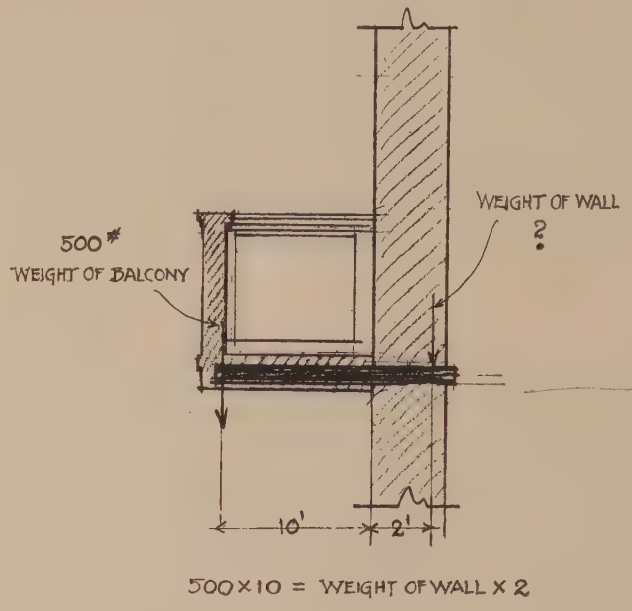
JIM'S MOMENT = TOM'S MOMENT

Woolworth Building are being punished much more than those under a little tombstone.

Now the building will stand up in a vertical position so long as there are particles in the way of the ones above. Build the building very tall, though, and it will begin to get wabbly, just as a long line of pushing people will begin to bend and wabble at the extreme end, when the people get anxious. Those at the end get to pushing hard, and some one

slips just a little off the centre of the line, and so the combined push of all causes a slipping to one side, and the line may break under the momentum. Watch a juggler pile on the top of a cane, a plate, a bowl, a lamp, and a number of other things. What does he do but constantly move the base around and about to keep it between the ground and the topmost members of the pile. But ever so slight a mistake about it and those articles at the top will slip by the ones below them and rush down quickly to the ground, as every amateur juggler has found out in his efforts to repeat the wonders of the professional performer.

But this desire of the particles of which a building is constructed to move downward is not always obstructed by other particles, directly in the way. For example, the particles on a balcony that hangs over the street have a clear path to fall to the ground, but they do not do it, because they are held to the next particle and the next one, all the way into the wall, by an internal force of attraction that exists between each particle. Of course, when the beams of the projecting balcony are made very long, we notice that the downward pull of gravity is slowly getting the better of the cohesion of the particles, for the outer end of the beam droops down below the level of the end held up in the wall, and we say the beam is bending.

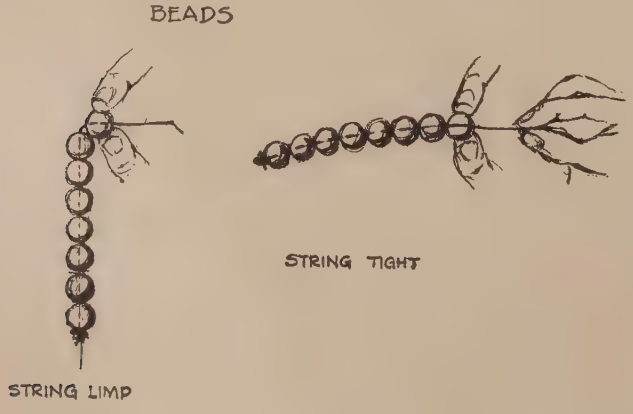


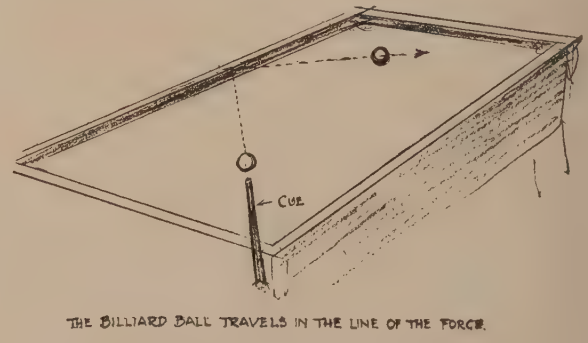
Old Archimedes nearly tumbled onto the idea of how this worked, but he came just short of it. If you will recall his statements about the balance scale as described in a previous article, you will understand how the seesaw here referred to, with Tom and Jim on it, balances and resembles somewhat the conditions of the beams that hold up a balcony. Jim weighs 200 pounds and Tom 100 pounds. When Jim sits on the left and 3 feet from the centre of balance and Tom sits on the right 6 feet from it, then the plank remains horizontal. That is, 200/6 as 100/3. It is not hard to convert this into the following form—that 200 × 3 equals 100 × 6. Yet Archimedes did not get this far in his reasoning. It seems incredible, but the relationship shown here was not set forth until Varignon published it in his book. He was the first to recognize clearly that a measure of the revolving action of a force could be had by multiplying the force by its distance out from the centre of revolution. Jim's 200 pounds multiplied by 3 feet caused the plank to revolve counter-clockwise. Tom's 100 pounds multiplied by 6 feet revolves the plank clockwise. We say Jim revolves it counter-clockwise 600 foot-pounds, and Tom revolves it clockwise 600 foot-pounds. Accordingly the plank does not revolve but remains in equilibrium. The revolving action of the forces was measured by their amount times their distance from the centre of revolution, called the lever arm. This measure is given the name of a moment.

Now Varignon stated for the first time that when the sum of all the moments acting upon a body equalize each other the body remains in equilibrium.

The beam holding up a balcony has a load on it that causes it to revolve about the edge of the wall. If the load of the balcony is assumed to act 10 feet out from the wall and the load is 500 pounds, then the moment is 500 × 10, or 5,000 foot-pounds. This is the moment that tends to revolve the beam of the balcony, and this must be equalized by another moment working in the opposite direction, produced by the weight of the masonry acting upon the end of the beam buried in the wall. Assuming the length of beam in the wall is 2 feet and the weight of the masonry acts upon the end of it, then 5,000 foot-pounds must be equalled by 2 times the weight of the masonry. Or the weight is 5,000/2 or 2,500 pounds.

Observe what is happening in the beam itself. We can roughly picture a very small thread of the beam to be like a string of beads. Each bead can be said to represent a particle of the beam structure, and the string may symbolize the cohesive force between the particles. If one bead is held tight, so that the hole in it, through which the string runs, is horizontal, and then the string is pulled tight, the beads will stiffen out from a drooping position into a curve, and, if there are not too many beads on the string, they can be made to straighten out into a horizontal line when the string is pulled very, very tight. This is a crude image of what is happening within the beam, for the particles in it are very small, and there are many of them, yet it is possible to think





THE BILLIARD BALL TRAVELS IN THE LINE OF THE FORCE.

of them as beads that resist the bending of the beam by their attraction for each other. As gravity creates a great bending moment, it must be equalized by these particles working in the opposite direction. Each one must create a small moment in the other direction, and the total effect of all of these moments must be great enough to balance the bending moment.

It is not difficult to see that to follow through a conception as complicated as this, no ordinary system of reasoning will do. In fact, there are an infinite number of particles, and the attraction between them extends in all directions in a most complicated way. But, as necessity is said to be the mother of invention, Newton and Leibnitz, who were face to face with the problem, proposed a higher order of thinking to solve the difficulty. This is now known by the name Calculus. Though these men developed the basic principles of this branch of mathematics, it was not until a hundred or so years afterward that it was universally accepted, and not until 1817 that a course in calculus was introduced into the curriculum of Cambridge.

To-day, when an engineer picks up his handbook and selects a certain-size beam to carry a special load, he is able to solve the problem in a few minutes, because a few great minds developed the system of reasoning of calculus which helped others to determine the proper sizes of structural members and tabulate the results. Concentrated into some of the tables in the handbooks are the results of the mental sweat of many generations of thinkers.

One can accept these facts and tables to-day, and go on with the practical application of them without questioning. This is a legitimate use of facts, but a dangerous one. Indeed, the practical inventor almost always owes half of his ideas to the scientist who never invents a thing but a new thought. However, the man who never studies calculus, but does use the handbooks, is in the same danger as the fellow who drives a car and knows nothing about it, but depends upon the service stations to take care of the breakdowns. Some day he may have a mishap far from a service station, though the chances each day are growing less and less as more stations are being built.

As we look back now at the manner in which the various ideas came into being, we can note certain salient ones that, taken as a whole, form the basic structure of our knowledge of mechanics. Let us tabulate them for examination.

Archimedes's ideas about the balance scale, and the centre of gravity.

Galileo's conception of a force changing the shape of a body or moving it, and his idea that a body consisted of small parts to resist this action.

The increasing sense of what a force is.

Stevinus's theory of the parallelogram or triangle of forces.

Newton's clearer ideas of this matter and further observations of what a force does to a body.

Varignon's clearer statements of the theory of the triangle of forces and also his statements concerning a moment and the principle of moments.

Newton's and Leibnitz's development of calculus to use in analyzing problems that could not be reasoned about with ordinary mathematics.

The accumulating results of experiments upon structural members and materials carried on in testing laboratories.

With this summary in mind, we shall, in the next article, stop to consider the wider significance of the force of gravity, and how in the light of modern research we have begun to see that the whole network of nature is an expression of the balancing of forces. We believe that this will be of particular interest to designers, for in it they may find the confirmation of many vague intuitions which they have felt to be true.

Announcements

After January 1, Leander McCord, architect, will move from 627 Power's Building to new location at 530 Sibley Building, 328 Main Street East, Rochester, N. Y.

Henry McCarrel, architect, Florida East Coast Railway Company, announces that after December 31, 1925, he will be associated with the D. P. Davis Properties as staff architect, with offices at St. Augustine, Fla. Manufacturers' catalogues and samples requested.

Messrs. Bacon and Lurkey, architects, wish to inform their friends and the public that their offices are now located at 991–997 Main Street, north of High Street, Buffalo, N. Y.

Henry C. Pelton, architect, Frank M. Machan, Charles Crane, Harold G. Webb, Associates, announce the removal of their offices to 415 Lexington Avenue, corner of 43d Street, New York City.

Mr. Richard H. Pratt resumed the practice of landscape architecture on January 1, 1926, at 101 Park Avenue, New York City.

Beginning January 1, Mr. Max Siegel became a member of the firm which will be known hereafter by the name of Cohen & Siegel, architects, 45 West 57th Street, New York City.

Book Reviews

OLD ENGLISH HOUSES. By J. A. Gotch. With numerous illustrations. E. P. Dutton & Co, New York.

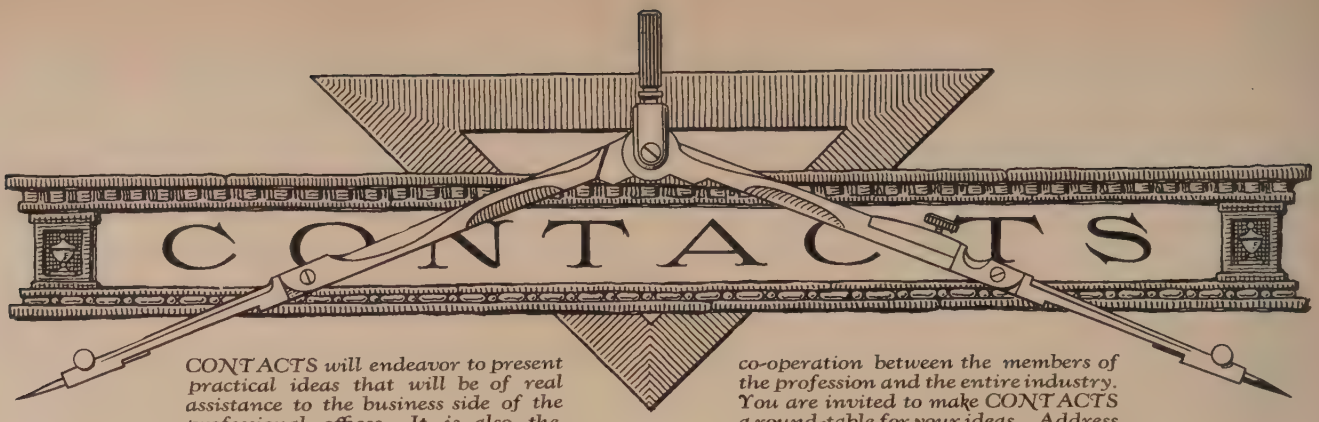
Taking the old houses of England as her text, the author gives us a very entertaining account of the social customs of the people of England from the time of the feudal barons to the present day, as well as of the dwellings which formed the background of their lives.

While describing the changing architecture of each period—Mediæval, Tudor, Elizabethan, Carolean, Queen Anne, Early Georgian, Late Georgian or modern—the author details the conditions which necessitated or inspired each architectural phase and of the resulting mode of life of those who inhabited these houses. Historical events are thus seen from their human side, so that the volume is both informative and amusing

THE DICTIONARY OF ENGLISH FURNITURE FROM THE MIDDLE AGES TO THE LATE GEORGIAN PERIOD. By Percy Macquoid and Ralph Edwards. With a General Introduction by H. Avray Tipping. Volume II (Ch–M). Fully illustrated, including fourteen plates in color. Charles Scribner's Sons, New York.

This is one of those remarkable books that they know so well how to do in England. They are makers of sumptuous books about architecture, gardens, furniture, the decorative arts in general, and happily the English printers and paper-makers contribute of their skill to these always handsomely illustrated and beautifully printed volumes.

There are many books on English furniture, large and small, but here is one that covers the entire field and does it in alphabetical order, making it a source of immediate reference. If you are interested in chests of drawers, in old clocks, if you want to look up Chippendale, mirrors, know about Hepplewhite, need to verify the authenticity, in accordance to form, of some antique, you may use your dictionary. It makes a specific reference, not one of generalizing and fine writing about the charm of antiques. As a reference we cannot praise this work too highly, and it has the authority of experts on the text, and the illustrations from notable private collections are adequate and representative of the best. The color-plates are admirable in their accurate presentation of textures and forms.



CONTACTS will endeavor to present practical ideas that will be of real assistance to the business side of the professional offices. It is also the purpose of CONTACTS to bring about a better understanding and co-operation between the members of the profession and the entire industry. You are invited to make CONTACTS a round-table for your ideas. Address CONTACTS, ARCHITECTURE, 597 Fifth Avenue, New York.

What Really Is the Ideal Specification?

By Stephen F. Voorhees

President of the New York Building Congress, Member of the Firm of McKenzie, Voorhees & Gmelin, Architects

I BELIEVE that the ideal specification is one which defines the functions to be performed by the parts described and puts upon the manufacturer the burden of proving that the product which he offers will function in the manner described.

Some specification work is done in this way in many architects' offices at the present time, and in our own office it is giving excellent results. As an example, I should like to cite a recent experience. On a large operation it was very essential in connection with the elevator service that the hoistway doors, saddles, hangers, operating devices, etc., should be co-ordinated in their functions so as to produce a certain definite and essential part of the elevator service for the building. We, therefore, called into conference the manufacturers of the various parts making up the hoistway door unit and found that practically all of these parts could be of standard manufacture with slight variations, but that the matter of assembling them has required special consideration.

After many conferences in our office and the manufacturers' shops, a functional specification was written, being really the combined notes of the several conferences. The contract was then awarded as a result of competitive bidding and the manufacture is now proceeding with every indication of a successful outcome. A thorough understanding of the service requirements on the part of the manufacturer of this equipment has been of the greatest possible benefit to the architect, and hence to the owner, in the development of the details which was done after the contract was awarded.

During these conferences, the manufacturers were not trying to sell their products, but they were wholeheartedly co-operating with the architect in arriving at the most desirable solution of the problem, and after the solution was reached they were able to compete, having a thorough understanding of the requirements. It is not possible, nor is it necessary, that all parts of the specification should be prepared in this manner. Standardized products can be used in a large majority of cases but it should be remembered that any standard worthy of the name is established by similar methods; that is, by co-operation between the designer and the maker, the architect and the producer, the buyer and the seller.

Is the "Best" Material the One to Use?

By Robert D. Kohn, Architect

MY client may say: "I want the best of this or that. This or that shall be the best—the best workmanship and the best material." Now, the best is not necessary in some cases. Many things are perfectly good enough in a certain situation. These superlative generalities that we have had pushed at us for so many years don't mean what they say. They can be interpreted in a dozen different ways.

In using the word "best" we have all been on the wrong track, doubtless. We have not meant what we said, and so, to even things up, the manufacturer claims for his particular product that it is the best.

To say that you want the best in every case is nonsense. The other day I happened to need a considerable quantity of metal-covered doors. If I were to merely specify "all the doors in this building are to be the best metal-covered doors, covered with twenty-gauge copper, or steel," it would be absurd. One manufacturer may make an excellent door, and so may another. As a matter of fact I had ten bids running from somewhere around ten to sixteen thousand dollars on that set of doors. Now, they were not all bidding on the same thing.

Between the sixteen and ten thousand dollar man there was probably six thousand dollars' worth of difference in workmanship and material. I don't need that sixteen-thousand-dollar man's product in the subcellar of the building, but I do need it in the elevator hatchway openings.

The building art has become very complicated. These fine distinctions between the ten and the sixteen thousand dollar doors are things that we architects have to study out.

I have to see how the manufacturer puts his stuff together. I must see his product somewhere to realize what his workmanship is. And advertising, in the long run, will have to get down not only to saying things, in a general way, about the product, but it will have to illustrate and point out where the product may be seen.

Now, as I take it, this problem of advertising, of having the manufacturer present information in such a form that the architect can really appreciate and use it, the problem of educating the architect to realize that he ought to know about these things, and the problem of the architect in getting this information and having it available when he needs it—those are all parts of this larger problem of bringing together the producer of building materials and the architect, that they may understand each other, and that the work of no branch of the industry may be in vain.

(CONTACTS—*Continued*)

How the Standard Specification Helps the Architect

Wherein Some Specifications Fail—The Responsibility of the Architect in Seeing that Specifications Are Followed

By Samuel Warren

FIRST let us define a "standard" as it refers to building material. It is a measure against which the materials are placed to determine if they fulfil certain minimum requirements. A standard is not a certain sample of the material involved. Usually it is several pages of printed matter. The standard for Portland cement is not a certain carefully guarded barrel of material, but is a general set of rules that any Portland cement must meet in order to be classified as Portland cement.

"Standards" for building materials and their use does not mean that every time the materials are put into a building the results are to be identical in form and shape, but it does mean that the material and the results secured shall meet a certain minimum requirement.

"Standards" do not mean that all houses must look alike or that all ornamentation shall be stock designs. It means that the resulting work shall be of not less than a certain quality.

In this connection I am going to again use for an illustration Portland cement, as it is a material with which I am more or less familiar. In one sense it is probably the most standardized material on the market, for it is quite invariably specified by all users to pass a "standard specification." In fact most of us consider that it is not Portland cement unless it does pass those specifications. To-day there are 90 to 100 companies manufacturing Portland cement. There are a legion of architects and engineers. A few years ago each company manufactured what it called Portland cement, and all these architects and engineers wrote out a long specification to enable them to get what they considered Portland cement; that is, unless they copied from some one else. Certainly it was a mess, and yet what every company and every user was trying to do was to specify a Portland cement that would accomplish certain minimum requirements. With time and experience they came nearer to agreeing on what these requirements were, and finally adopted a standard specification for Portland cement.

To-day the architect in New York who designs a concrete job in California or Texas knows exactly how his Portland cement is going to act. In the old days he would have had to examine all the local cements to find out what they could do and see if they were acceptable for his use.

The company that twenty years ago shipped from one mill, to-day with many mills covers the entire country and often the world. In the same way our architects and engineers design structures not only in their own native town but all over the world. It was only a few weeks ago that I was helping one New York architect on his specifications for a stucco house in Constantinople, and another one a stucco bank building in Honolulu. On each of these was to go "standardized" white Portland cement. These architects knew because it was a "standard" that it would accomplish their requirements fully as well in those countries as in New York.

Just think how much time and labor this one standard specification has saved the architectural profession. His private specification on Portland cement used to be almost a small volume in itself, and to write it intelligently he had to make quite a study of the material. To-day he sums it all up in one line: "The Portland cement shall pass the standard specifications of the American Society for Testing Materials." What architect to-day would willingly go back to the times when he wrote his own?

Nor does a standard specification mean lack of progress or prevent the bettering of the materials used for certain purposes. Some of you will remember natural cement that made our early concrete and built the old Erie Canal. It was made of the same ingredients that form our present Portland cement, but it finally was discarded in favor of standardized Portland cement, and not so much because of its low strength but because of its uncertain or "unstandardized" strength.

Standardization does not mean stagnation. It does not prevent improvement in the standardized material. It does not prevent designation of materials by brand when certain brands are known to have back of them a reputation for uniformity of quality and a manufacturing organization that keeps its promises on delivery and has a reputation for fair dealing.

Standardization of both the basic materials and the application of the material does not mean monotony of results. Let us take a specification for Portland-cement stucco. First you specify a standard Portland cement, then a standard sand, and then a standard hydrated lime, and you specify just how each coat is to be applied, and yet without changing these specifications you have every latitude for color and texture. In fact you cannot get or want two stucco jobs that will look exactly alike.

So standardization is not stagnation, not monotony, not sameness, not a prevention of securing individuality and craftsmanship, but a group agreement that there are certain basic qualities that material and workmanship shall meet.

Should not the architect, then, insist on standard specifications for the materials that he uses? Does it not devolve upon him and his associates through their powerful organization, the American Institute of Architects, to further the setting up of standards, not that all buildings may look alike, but that the architect's client may be more fully protected?

But unless we have some fundamental background, some foundation for specifications, how can we expect to ask the architect to insist that these specifications be followed out?

Is not the most common failure of specifications the "or equal" clause? Much has been argued on this clause, but is not the fundamental reason that it appears in specifications the fact that materials are not standardized?

Therefore, is not "The Responsibility of Architects in Seeing that Specifications Be Followed" fundamentally a question of first establishing standards both of materials and specifications? Let us, the architects and manufacturers, establish proper specifications, and then both insist upon their being followed.

(CONTACTS—*Continued*)

What I Think of "Or Equal"

Is It a Help or Hindrance in Obtaining the Best Material?

"OR EQUAL" IS A HINDRANCE

I have abandoned use of "or equal" in my specifications. IT IS A HINDRANCE.

I try to know what I want to use, and have developed the courage to say so; not leaving decision to some one else who will likely decide upon what nets him the greatest direct saving.

I believe "or equal" is often used to "salve" the manufacturers who have not been mentioned. Its use is again prompted in the hope that the dealer in goods desired will not heed a temptation to "boost the price." Its use may also relieve the architect of a chance accusation that he has "sold out."

Its use does often permit interested competition, since some contractors may have more favorable buying conditions at one distributor than at another.

Having considered these points, I have concluded that at no time can all goods of a kind be used on any project; that it is up to me to know what will best fit the case and what is most economical, durable, and readily available. Make a choice and make it "stay put." My sole idea is to make the specification as definite and final as possible. It expedites bidding, buying, organization, and progress.

CHARLES W. STEINBAUGH,
Architect, Omaha, Neb.

A CONVENIENT PHRASE

"Or equal" is a convenient phrase never used by Hewitt and Brown because it is subject to misinterpretation by bidder and contractor in that it does not contain any indication as to who is to be the judge of equality, and opens the way to unwilling concession by the architect or engineer. Hewitt and Brown use the following phrase prefixed to their specifications:

"The specialties particularly named in their specifications shall be considered as standards: bids on proposed substitutes of like character and value are invited and will be analyzed and compared on a basis of quality, price, and availability.

"Bidders on this work must have their bids on the specialties named: substitutes must be offered as an addenda to the original bid."

P. O. KIRK,
In charge of specifications for Hewitt and Brown, Architects, Minneapolis, Minn.

THREE REASONS IN FAVOR OF "OR EQUAL"

For three important reasons, I sometimes specify the term "or equal" in calling for a particular article entering into the erection of our buildings.

First. I do not want any manufacturer to get the impression that his material can be used without competition and at any price, and one of the several manufacturers may be equal in quality and the advertiser's printed specification of the article named may be a brief method of my more detailed and voluminous specification. Architects should refrain from writing things not absolutely necessary.

Secondly. I may learn that another manufacturer's article may be more suitable for the purpose and easier to obtain.

Thirdly. The architect should maintain the high standard of the architectural profession, and do everything possible to discount the erroneous idea that he has any preference of materials other than that necessary to serve his client best.

JOHN B. SLEE,
Of Slee & Bryson, Architects, Brooklyn.

THE OWNER GENERALLY GETS WHAT HE PAYS FOR

I believe the use of the phrase "or equal" is sometimes serviceable but that it must be used with caution, and decisions under it are frequently extremely difficult to make. The difficulty is that in very many branches of the industry there is no fixed standard and no exact conformity to any standard by its manufacturers of different products of the same kind. If one specifies a single material that is known to be satisfactory one is apt to consider whether the quotation on it is as low as if there had been some competition.

On the other hand, if one specified the same thing with some other material also allowed, that was as nearly as possible equivalent, it is quite likely that a cheaper grade would be figured and furnished without its being possible for the architect to detect the difference. There are frequently grades within a company's listing of its own products known only to itself. The question is whether the selection must be made in the last analysis on price or whether the owner can and should buy an appropriate grade of material at a fair price. In the commercial markets of the building industry the owner generally gets about what he pays for, and it is a rare architect that can secure for his client any more than that.

The refusal of many material manufacturers to quote direct to an architect makes it impossible for him to secure actual prices on different materials and make his selection in advance of general bidding on the work. This is an excellent plan in securing subcontract proposals and would be a good way to determine the *economical* (not cheapest) materials to be used, if it were possible.

Specifications should, so far as possible, be drafted so as to permit the submission of bids on a uniform basis. For this reason I have sometimes specified a definite kind of plumbing fixtures (for instance) and called for all bids to be based on that list, but permitted bidders to submit alternate bids on a detailed alternate list submitted by them if they desired. The award would be based on the quotations on the specified list and subsequently an alternate list approved if after careful analysis it was found to be actually equivalent and as desirable as the list specified, but the original list adhered to if a change was felt to be undesirable.

When you know what the owner needs, and that he can afford to pay a reasonable price for it, specify it direct. The chances are the owner will get more for his money under such conditions.

WILLIAM STANLEY PARKER,
Architect, Boston.

(CONTACTS—*Continued*)

What of This Stranger, Structural Steel?

How the New Standard Prevents Waste—The Code as the Aid to Specifications

By Charles F. Abbott
Executive Director, American Institute of Steel Construction

FOUR decades ago architects and engineers were confronted with this stranger called structural steel. There were fortunately no construction precedents to guide them, and the science of structural engineering was not thus hampered in its natural development. The manufacturer of the fabricated product invented machinery to facilitate its production and lessen its cost. The producers of steel modified the sections of the various shapes so as to better and more completely utilize the inherent strength of each pound of the material. They also perfected the quality of the material both as to its chemical constituents and their correct proportionment, and also improved its physical properties by better manufacturing processes.

The erectors of structural steel steadily developed a better and stronger type of derricks, hoists, and other installation apparatus with which they could erect the steel more quickly and economically, and which also permitted the engineer to design larger and heavier structural units.

The progression of structural steel, considered in its entirety, is a splendid pageant displaying a fine co-operation between the architect and the structural engineer, the producer and the manufacturer. Each advancing step made by one of the co-operators was met immediately by a corresponding advance by the other one most affected. These men have been fearless and at the same time conservative and sure. Whatever the demand has been, they have entirely satisfied it in a correct manner. Their splendid example has been emulated by the mechanical and electrical engineer, the heating and ventilating engineer, and those others who have developed the minor accessories of the modern building. All of this progress is due largely to freedom from the inhibitions of precedent—a single generation has made this marvellous advance!

And what of structural steel to-day? With others who constitute the building industry, the producers and manufacturers of structural steel became aware, after the late war, that a new era was at hand, and, with them, they directed their attention to the problem of the simplification and standardization in order to eliminate waste. To this movement, inaugurated by Secretary Hoover, of the United States Department of Commerce, the structural steel industry responded immediately. The organized manufacturers of fabricated structural steel, functioning as The American Institute of Steel Construction, selected a committee of distinguished and disinterested engineers and architects to formulate a specification for structural steel for buildings to accomplish the simplification and standardization of the product and the elimination of waste.

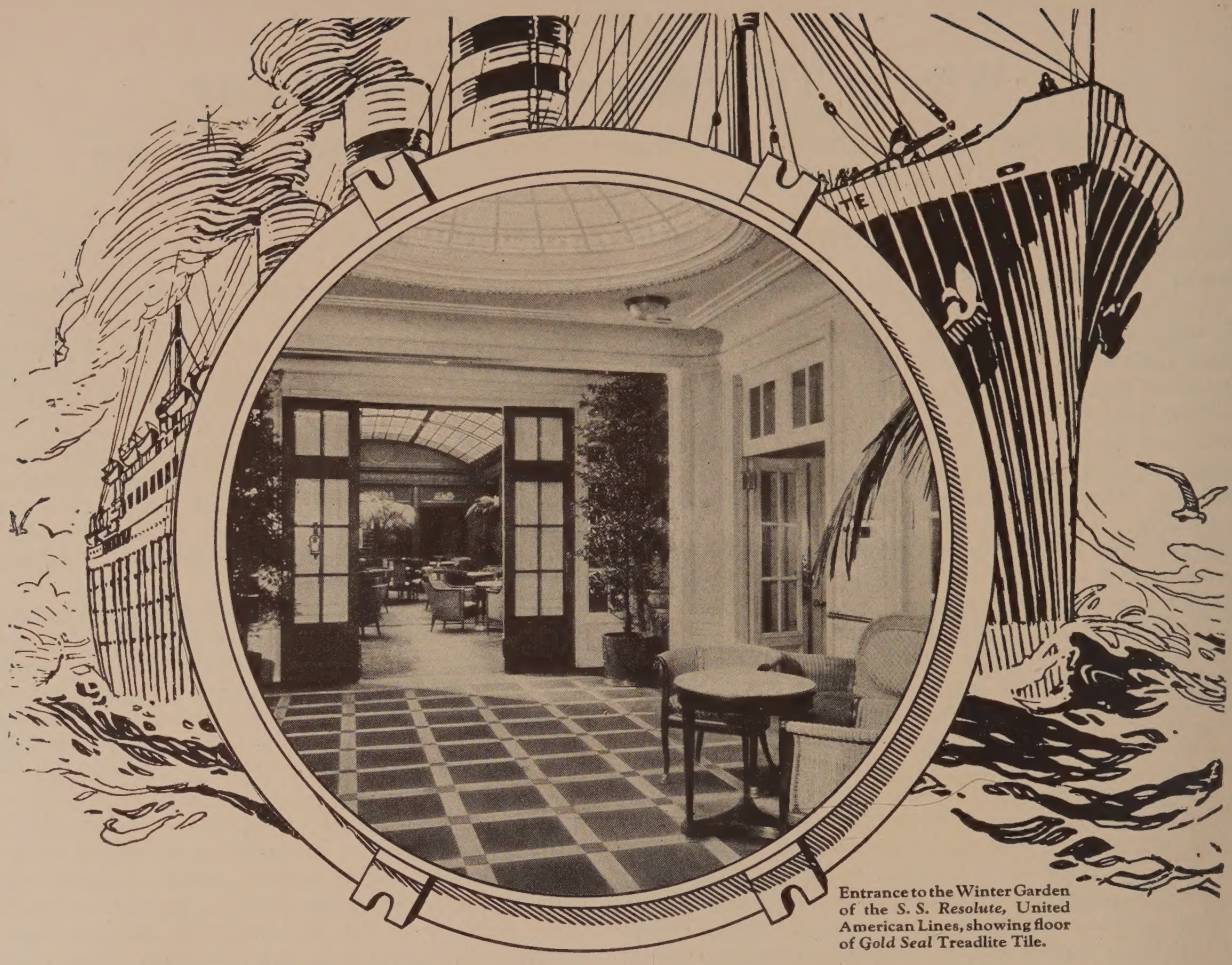
The committee found that notwithstanding the great improvement in the quality of structural steel, due largely to the superseding of the Bessemer by the open-hearth process and the improved methods of controlling its chemical composition, the same fibre stresses were in vogue that were adopted when structural steel was first used. This alone was an important source of waste. Notwithstanding that a committee of the American Society of Civil Engineers had recommended the use of a fibre stress of 20,000 pounds per square inch for shapes subject to bending stresses, the committee recommended the use of a stress of 18,000 pounds per square inch instead of the prevailing stress of 16,000 pounds per square inch. Other factors of the specification were adjusted in harmony with this basic stress. The institute initiated an energetic campaign to secure the adoption of this specification in new or revised building codes. The result has been very gratifying. Its use will result in a distinct saving in the cost of structural steel by permitting the use of stresses to which it is entitled by every consideration of good engineering practice.

Another important work of the institute has been the formulation of a Code of Standard Practice. This consists of the segregation of the multitudinous items of steel and iron that enter into building construction into four groups denominated as Classes A to D, inclusive, with a list of materials not included under the above classifications and furnished only by special contract. The increase in the number of steel and iron items has been very rapid because of the more extended use of the metal. Specification writers could, some years ago, include all of these items in one specification. The natural development of manufacturing processes made it desirable that plants be equipped and organized along special lines, and that it was impossible for any one plant economically to produce all of the steel and iron items mentioned in a complete specification.

The result of the usual manner of writing specifications has resulted in an overlapping of items so that no one manufacturer could produce all of those included in the specification. This compelled the manufacturer to secure quotations from others who specialized in certain items. This naturally resulted in a second profit being added to the original cost, causing unavoidable waste. This practice also caused confusion because no two architects followed a specification standard. The practice was expensive for the owner, annoying and confusing to the steel and iron contractor, and led inevitably to disputes between all of the parties.

The specification evils of classification are corrected in this Code of Standard Practice. Its use does not involve any additional labor on the part of the specification writer; it is based on current manufacturing practice which is entitled to consideration. This standard classification and segregation of the steel and iron items places the work in the hands of those specializing in their manufacture and installation. The Code of Practice also includes sections covering invoices, drawings and specifications, workmanship, inspection and delivery, erection, delays in prosecution of work, extra work, and proposals and contracts. The Code provides for an equitable relationship between all of the parties involved. Practical experience and actual conditions of the industry guided its formulation. The adoption of this Code by architects throughout the United States has made marked progress.

[*Note.*—This Code of Practice and the Standard Specification will be sent to architects at their request of the Contacts' Editor.



Entrance to the Winter Garden of the S. S. *Resolute*, United American Lines, showing floor of *Gold Seal* Treadlite Tile.

Bonded Floors go 'round the world—

In January, the ocean liner *Resolute* sails out of New York harbor for a lengthy round of pleasure, a 'round-the-world cruise ending late in May.

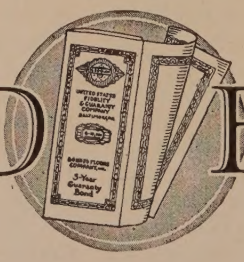
Everything possible has been done to convert the big liner into a luxurious floating home. Bonded Floors of *Gold Seal* Treadlite Tile, attractive, quiet and comfortable, are part of the special equipment and furnishings provided.

The same reasons that have led the big steamship companies to select Bonded Floors for the *Resolute* and other large ships make them the logical choice wherever attractive resilient floors of proven durability are desired.

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From the drawing by Gerald K. Geerlings.